

Plants and butterflies of a small urban preserve in the Central Valley of Costa Rica

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Abstract: Costa Rica's most populated area, the Central Valley, has lost much of its natural habitat, and the little that remains has been altered to varying degrees. Yet few studies have been conducted to assess the need for conservation in this area. We present preliminary inventories of plants, butterflies, and day-flying moths of the Reserva Ecológica Leonelo Oviedo (RELO), a small Premontane Moist Forest preserve within the University of Costa Rica campus, located in the urbanized part of the Valley. Butterflies are one of the best bio-indicators of a habitat's health, because they are highly sensitive to environmental changes and are tightly linked to the local flora. A description of the RELO's physical features and its history is also presented with illustrations. Approximately 432 species of *ca.* 334 genera in 113 families of plants were identified. However, only 57 % of them represent species native to the Premontane Moist Forest of the region; the rest are either exotic or species introduced mostly from lowland. More than 200 species of butterflies in six families, including Hesperidae, have been recorded. *Rev. Biol. Trop.* 57 (Suppl. 1): 31-67. Epub 2009 November 30.

Key words: biodiversity, urban biological conservation, day-flying moths, Lepidoptera, premontane moist forest, Costa Rica.

Costa Rica's Central Valley (Fig. 1), where the capital city of San José is located and over 40% of the country's entire population reside (ICT 2007), may be roughly defined as an area delimited by Carrizal, Grecia to Turúcares in the Northwest, Cerros de Escazú in the Southwest, Cerro de Ochomogo in the Southeast, and El Zurquí de Moravia in the Northeast. Along the edges of the Valley are several protected areas, such as the upper part of Cerro Carpintera, Cerros de Escazú, Braulio Carrillo National Park bordering El Zurquí, and Zona Protectora El Rodeo, but these are essentially located outside the Valley. The flat land of the Central Valley, the so-called 'Meseta central', has long been the coffee belt (León 1948). Further reduction of the natural habitats

(Sánchez-Azofeifa *et al.* 2001, Vega & Valerio 2002, Bertsch 2006, Programa Estado de la Nación 2006) and uncontrolled introduction of exotic and other non-local ornamental plants (Chacón & Saborío-R 2006), especially in San José and other populated areas of the Central Valley, have adversely affected the biodiversity in these areas. Lack of substantial green space that preserves natural vegetation within these populated areas is another major contributing factor to this trend.

Efforts towards the inventory of Costa Rica's biodiversity of plants, fungi, insects and some other invertebrates were pioneered by the National Museum at the end of the XIX century, by the University of Costa Rica since 1941, the National University (since 1973), and

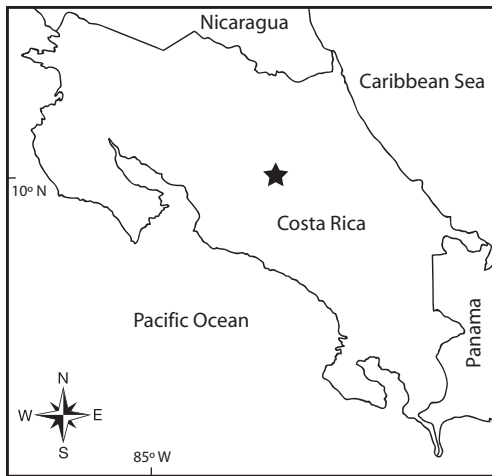


Fig. 1. Costa Rica, Central America. The capital city, San José, is located in the Central Valley (star). UCR main Campus is located East to the capital city.

recently by the Instituto Nacional de Biodiversidad (INBio). The latter uncovered approximately 2500 new species in the last 17 years of operation (INBio 2004, 2005, 2007), and the massive caterpillar rearing project led by D.H. Janzen & W. Hallwachs over nearly 30 years has produced a large and invaluable database on the Lepidoptera and their parasitoids of the Area de Conservación Guanacaste (Janzen & Hallwachs 2007a, b). These projects specifically target large protected areas. It is unfortunate that much less attention has been given to the unprotected areas and urban preserves, where rapid and extensive destruction, fragmentation and alterations of natural habitats are in progress at an ever accelerating pace. Clearly, an urgent need exists for preserving natural habitats and studying what may still survive in such areas. Nowhere is this need more acute than in the Central Valley (see Discussion), yet only a few such studies have been conducted thus far with regard to butterflies. Besides DeVries (1987, 1997), which covers the entire country, the list of butterflies found in the Premontane Wet- to Tropical Moist transition to Premontane Forest (Holdridge 1967, Bolaños *et al.* 1999) of Zona Protectora El Rodeo by

Vega & Gloor (2001) may be the only relevant survey available, even though it again deals only with large protected areas. Fulton's list (1966) of Central Valley butterflies is older, but the species obtained outside the Central Valley are included without distinguishing them from the former, depriving it of potential usefulness for the current purpose. With regard to plants, the floristic composition study in Zona Protectora El Rodeo done by Cascante M. & Estrada Ch. (2001) is probably relevant; although El Rodeo is strongly influenced by the dry Central Pacific climate.

It is in these contexts that we present here the results of our survey of the plants and butterflies in the Reserva Ecológica Leonelo Oviedo (RELO). This small urban preserve is located on the campus of the University of Costa Rica (UCR) in San Pedro, entirely surrounded by an urban environment (Fig. 2). Besides many small student projects related to class assignment and others conducted in the Preserve, only three previous studies on the RELO are known with regard to the butterflies and plants. G. Stiles (unpublished & pers. comm. 2005) mark-recaptured ithomiine butterflies between 1975 and 1981; Di Stéfano *et al.* (1996) studied regeneration of the forest and included a list of tree species; and A.C. Guardia Orozco (1998) examined the number of species of butterflies to analyze the island effect, namely the relationship between the area size and the number of species in fragmented habitats. Additionally, an unpublished list of the papilionid, pierid, and nymphalid butterflies was compiled in 1996 by P. E. Hanson based on the collection of insects at the School of Biology, UCR.

Finally, a few words may be appropriate on the advantages of studying butterflies and plants. Invertebrates, particularly herbivorous insects, are good bio-indicators of habitat changes (Andrade-C 1998), because they are usually abundant, allowing quantitative and statistical analyses; easily manipulated without altering their behavior; and tightly linked to the local flora (Pearson 1994). Within the insects, butterflies (including moths) have been used

as an ecological indicator of habitat conditions in ecological assessment (e.g., Holloway & Hebert 1979, Daily & Ehrlich 1995, Brown 1997, New *et al.* 1995, Solis & Pogue 1999). The advantages of butterflies are a) their relatively well-known taxonomy and biology, b) relative ease of observation, and c) their attractiveness to the public in general (Andrade-C 1998). Furthermore, they are highly sensitive to changes in the habitat and climate conditions such as temperature, humidity, and light intensity (Kremen 1994, Sparrow *et al.* 1994, Brown 1997).

We present preliminary lists of plants and day-flying macrolepidoptera of the RELO and UCR campus for the first time as part of the foundation for biological and ecological studies in urban ecosystems (Pickett *et al.* 2001). Physical description and illustrations of the Preserve and its history, and some photos of butterflies and plants are included. Current conditions of the RELO and its conservation need and importance are discussed.

MATERIALS AND METHODS

Identification of plants (Pteridophyta, Spermatophyta: Gymnospermae, Angiospermae: Liliopsida, Magnoliopsida) was conducted mostly during August and September, 2007, using live materials and observations through binoculars, in and outside the RELO on campus, but not beyond the Loop line Road (Fig. 5). Most of the plants were reviewed and identified by the third author (C.O.M.); some were collected and pressed for identification at a later time. Nearly all of the recently planted tree saplings were not included in the list, because it is unknown whether these trees will survive.

Butterflies (Hesperioidea and Papilionoidea) and Macrolepidopteran day-flying moths, including Pyraloidea, were collected between September 1997 and September 2007. A few observations were made on campus outside of the RELO. The butterflies were mostly collected by the first and second authors, using

insect nets, but others were either collected using banana-plantain bait traps (Austin & Riley 1995, Shuey 1997) or were reared from their immature stages using plastic bags by the first author. The collecting was done more or less randomly throughout the years, i.e., the effort and methods were not evenly distributed but opportunistic. Thus the missing dates of collecting in Table 2 do not indicate their absence. Most of the adult specimens were pin-mounted and preserved in the entomological collection of Museo de Zoología (MZ-UCR), Escuela de Biología, UCR. Data from the students' entomological collections and the butterfly list compiled by P. E. Hanson (1996) were combined with our own data. A list of Ithomiinae (collected between 1979 and 1980) provided by G. Stiles (unpublished) was added in the list. Nomenclature for butterflies follows Wahlberg *et al.* (2005), Lamas (2004), and Mielke (2005). The Herbarium of the University of Costa Rica (USJ) and Smith *et al.* (2004) were consulted for identification of plants. For scientific names of plants, Missouri Botanical Garden (2007) was consulted. Host plants of reared butterflies are given in Table 1 and also found in Beccaloni *et al.* (2008).

Study site: Reserva Ecológica Leonelo Oviedo (RELO) (*ca.* 1160 m above sea level; 09°56'15"N, 84°03'00"W), commonly known as 'bosquecito' ('small woods'), is located on the campus of UCR, in San Pedro de Montes de Oca, San José province, Costa Rica (Figs. 1-5). It is located approximately in the center of the loop-line road and contiguous northwestward from the School of Biology building.

The University campus is located in a large urbanized area of Montes de Oca, one of the 12 metropolitan counties of San José (Bertsch 2006), and the surrounding areas are therefore highly disturbed (Figs. 1, 2). The RELO is a 37-year old secondary growth forest, formerly a coffee plantation (Fig. 4) (J. Di Stéfano, pers. comm. 2007), covering an area of approximately 1.5 ha. (*ca.* 100 x 150 m) and more or less bordered by the Negritos creek several meters wide, one running through the north and the



Fig. 2. Satellite image of San Pedro area in 2007, showing UCR campus and vicinity. The Leonelo Oviedo Ecological Preserve (RELO), is pointed by the arrow. (Source: DigitalGlobe® 2007, modified).

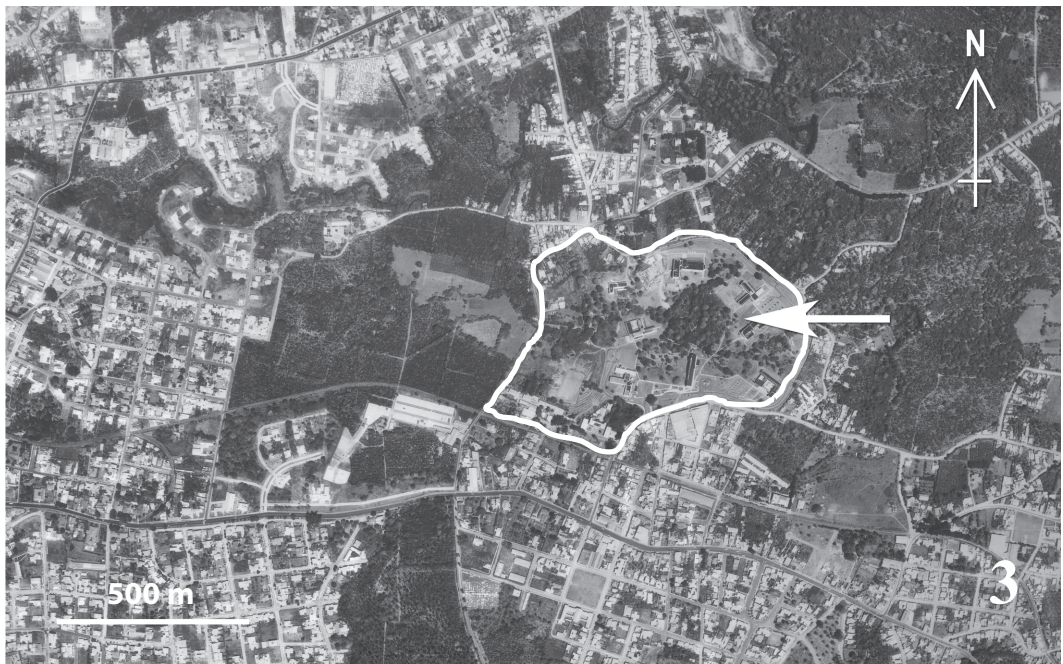


Fig. 3. Aerial photo of the University of Costa Rica main campus and vicinity in 1972. Arrow pointing at the Leonelo Oviedo Ecological Preserve (RELO). Note the coffee plantations in the west and southwest. (Source: Tropical Science Center, San Pedro, Costa Rica, modified).

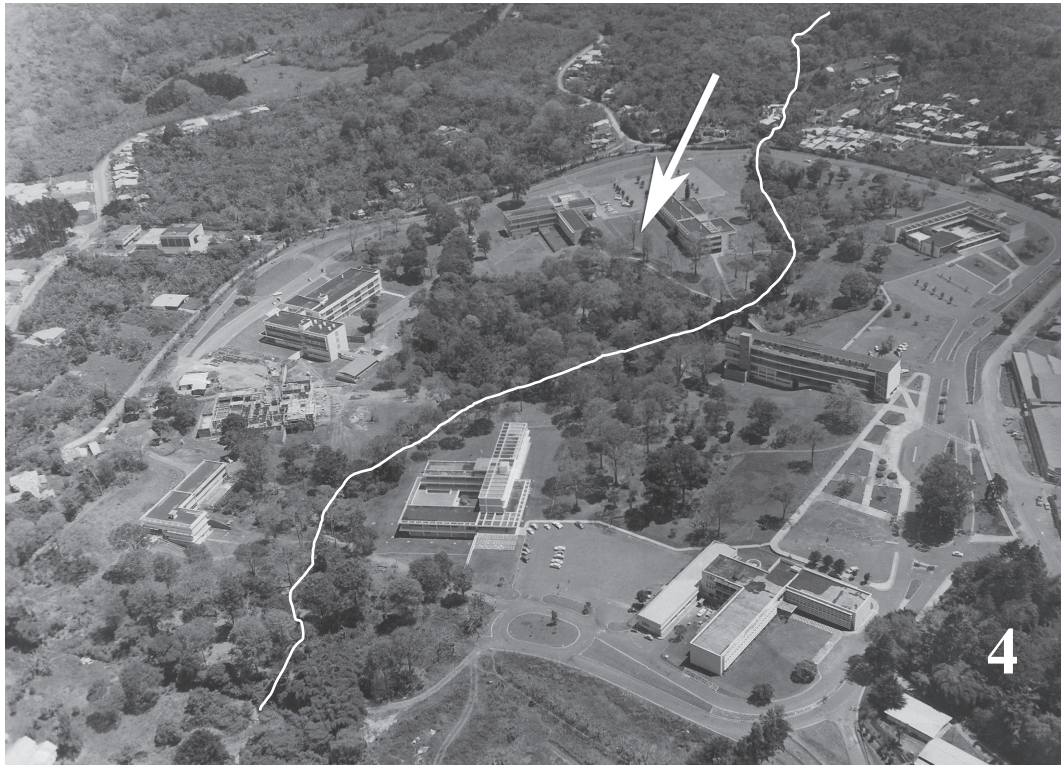


Fig. 4. Aerial photo of the UCR campus under development in the 1960's. The Leonelo Oviedo Ecological Preserve (RELO) in the middle includes a few young trees. Arrow points at the yet to be constructed School of Biology building. Note the green area in northeast side beyond the campus loop-line road. The white line across the photo follows the track of the Negritos creek. (Source: Escuela de Arquitectura, UCR, modified).

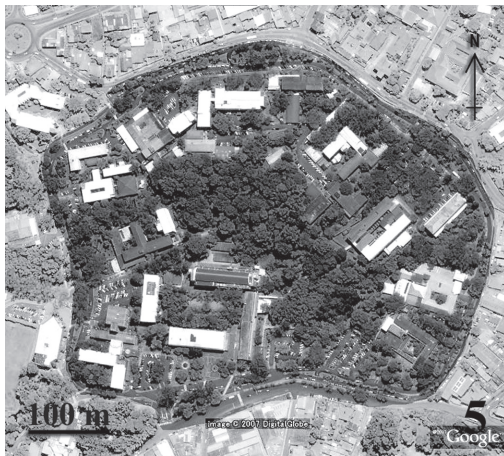
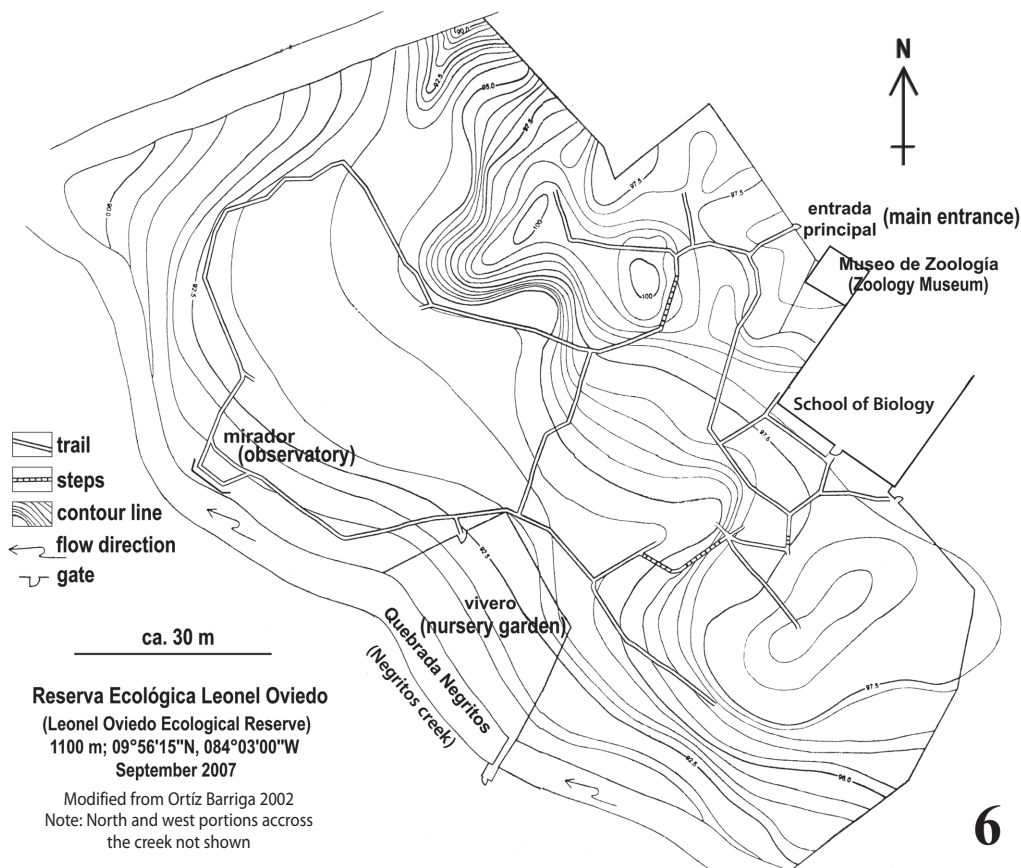


Fig. 5. The Leonelo Oviedo Ecological Preserve (RELO) (most of the green area in the middle) and the limit of studied area for the plant list on campus of UCR (saturated colored area inside of loop-line road). (Source: 2007 DigitalGlobe®, modified).

other on the west side (Fig. 6). The ecological life zone is Premontane Moist Forest after Holdridge (1967) & Bolaños *et al.* (1999), though this designation is not concurrent with current habitat conditions. The biotic condition is moist subtropical with 5 or 6 dry months annually according to Herrera S. & Gómez P. (1993). The RELO usually becomes relatively dry during the last half of the dry season (between early February and late April), with fallen dry leaves covering the forest floor (Figs. 12, 13), and is wet to fairly moist during the rest of the year (Figs. 7-11, 13). The differences in the green density are quite notable between the dry and wet seasons (K. Nishida, personal observation 1998-2007). The average climatic data of the UCR campus between years 2001 and 2004 are as follows: minimum and maximum temperatures are 16°C and 25°C, respectively;



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Fig. 6. Map of the Leonel Oviedo Ecological Preserve (RELO), University of Costa Rica main campus. Note that the map shows the approximate form and structure of the Preserve. (Ortiz Barriga 2002, modified).

average monthly rainfall in the dry season (December to April) was 23.1 mm; in the wet season (May to November) it was 235.6 mm (data from Centro de Investigaciones Geofísicas, UCR).

Some of the recent activities at the RELO are:

- Planting of *Miconia calvescens* (Melastomataceae) in the west (Fig. 10) and east sides by Proyecto Miconia in late 2002 to mid-2003.
- Installation of flagstones and pebbles along the trails in early 2006.
- Construction of a look-out area on the south bank of the Negritos River in early 2006.
- Officially associated with the Environmental Education Program by Comisión de Colecciones in the middle of 2006.
- Installation of a signpost at the main entrance (Fig. 7) at the end of 2006.
- Reforestation of west and northwest sectors with nearly 200 specimens of young trees. These trees were donated by Professor E. García and part of the planting was conducted by students of the Escuela Monterrey, in early to middle 2007.

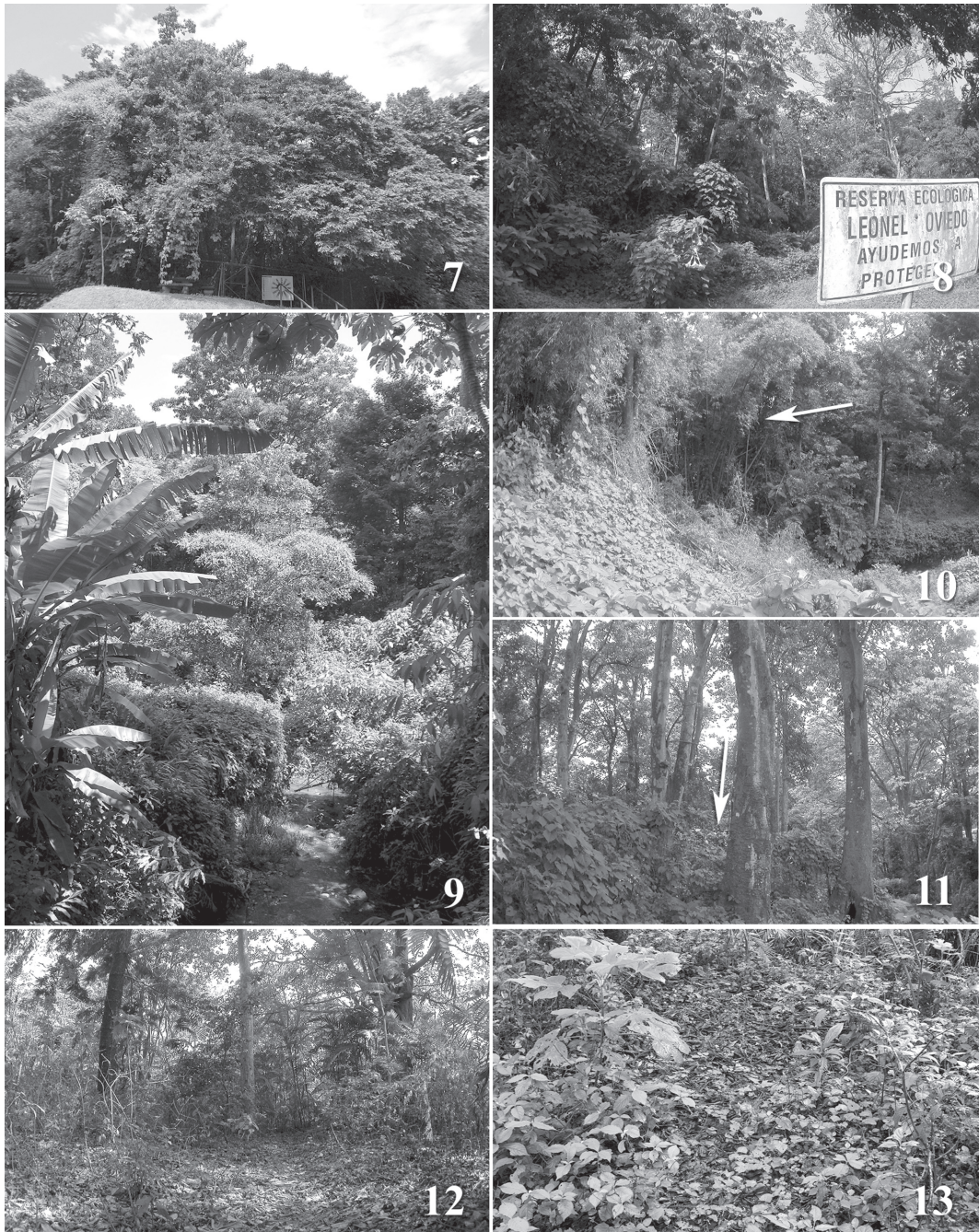


Fig. 7. Northeast side showing the main entrance of RELO and signpost (view from outside, August 18, 2007). **Fig. 8.** North side showing the Leonelo Oviedo Ecological Preserve (RELO) sign (view from outside, June 18, 2005). **Fig. 9.** South side showing Negritos Creek (view from outside on bridge to General Education building, August 18, 2007). **Fig. 10.** West side showing large *Erythrina poeppigiana* trees and arrow pointing at planted *Miconia calvenscens* (September 12, 2007). **Fig. 11.** Southwest side showing open thicket composed mostly of *Ipomoea* in front (along Negritos Creek) and *Guadua angustifolia* bamboo thicket (arrow) (September 5, 2007). **Fig. 12.** Forest floor of late dry season (April 22, 2006). **Fig. 13.** Forest floor of early rainy season (May 18, 2005).

- Initiation of topographical mapping in collaboration with the School of Topography, UCR, in March 2007.
- Conclusion of the Total Tree Inventory in the middle of 2007.

Leonelo Oviedo was a professor of the School of Biology at the UCR in the 1960s and 1970s. During that time he worked on establishing the Ecological Preserve, and he contributed more towards its development than anyone else. The Preserve was later named in his honor by Dr. Luis A. Fournier (José Francisco Di Stefano 2005, pers. comm.), also a professor of the School of Biology.

Vertebrates: Some vertebrates recognized in the RELO are as follows. At least two individuals of the two-toed sloth, *Choloepus hoffmanni*, have lived more than 10 years and have reproduced –about five individuals were observed at one point–. The most abundant mammals are the bats that use the Preserve as refuge and feeding site and serve for plant pollination (J. M. Mora, pers. comm.). The Variegated Squirrel, *Sciurus variegatoides*, has frequently been observed. An agouti, *Dasyprocta punctata*, was seen twice between 2000 and 2004 (K. Nishida & I. Nakamura, pers. obs.). One of the commonly seen birds is the Blue-crowned Motmot, *Momotus momota*. The Lineated Woodpecker, *Dryocopus lineatus*, and Grey-necked Wood-rail, *Aramides cajanea*, are new comers to the Preserve since 2002, though approximately 40% of what existed on campus *ca.* 20 years ago is no longer observed (G. Barantes, pers. comm. 2007, in manuscript). A few reptiles and amphibians that stand out are: a coral snake, *Micrurus nigrocinctus* (Girard); a boa, *Boa constrictor* L.; a Plain wormsneak, *Geophis hoffmanni* (Peters); an Olive lizard eater, *Mastigodryas melanolomus* (Cope); a glass frog, *Hyalinobatrachium fleischmanni* (Boettger); a tree frog, *Smilisca sordida* (Peters); a lizard, *Norops intermedius*; and the toad *Ollotis coccifer* (Federico Bolaños, pers. comm. 2005).

Even in the midst of human “development” and habitat changes, several new and rarely collected insects have been discovered and described from inside and outside the RELO on the campus of UCR. For example, three new species of weevils with unusual biology (Prena & Nishida 2005; C. Lyal & K. Nishida, in preparation; J. Prena, pers. comm. 2003), four new parasitoid wasps with new biological data (Hanson & Nishida 2002, 2004, Fortier & Nishida 2004, Shaw & Nishida 2005), possibly a new species of katydid (P. Naskrecki, pers. comm. 2005), and two new records of rare-in-collections moth species –*Venadicodia caneti* Epstein & Corrales (K. Nishida & M. Epstein, in preparation) and *Filinota brunniceps* (Felder & Rogenhofer) (D. Adamski & K. Nishida, in manuscript)–. At least one new species of skipper butterfly, *Quasimellana*, was collected at the RELO (L. R. Murillo, pers. comm. 2006). Some of these species are currently only known from the campus of UCR, i.e. are not known from anywhere else in Costa Rica. It is also noteworthy to mention the discovery of a rare Ascomycetes fungus that has only been found once in another part of the world (J. Carranza & J. Di Stefano, pers. comm. 2007).

ANALYSIS

Plants (Figs. 14-24, Table 1)

Table 1 shows the list of vascular plants resulting from the present inventory. There were some technical difficulties in identification of sterile plants of Araceae and Asteraceae, and Pteridophyta. The following summarizes Table 1: There were eight families of Pteridophyta with 14 species in approximately 14 genera; seven Gymnospermae with 10 species in eight genera; 26 Monocotyledoneae with 121 species in 84 genera; and 72 Dicotyledoneae with 286 species in 228 genera. Thus, the total species number was 432 in approximately 334 genera within 113 families. We recorded *ca.* 205 species in the RELO (excluding nursery garden). Of these 205 species, 64 species (*ca.* 31%) were present exclusively in the RELO,



Fig. 14. *Chamaedorea costaricana*, flowers (December 14, 2002). **Fig. 15.** *Costus pulverulentus*, inflorescence and flower (August 18, 2007). **Fig. 16.** *Pseuderanthemum cuspidatum*, flowers (Sept. 5, 2007). **Fig. 17.** *Senna papillosa*, flowers (April 13, 2004). **Fig. 18.** *Rivina humilis*, flowers and fruits (December 18, 2002). **Fig. 19.** *Aristolochia grandiflora*, flower (April 28, 2004). **Fig. 20.** *Inga vera*, flowers (white) and new flushing leaves (reddish) (April 13, 2004). **Fig. 21.** *Hamelia patens*, flowers and fruits (April 13, 2004). **Fig. 22.** *Passiflora biflora*, flower (March 23, 2004). **Fig. 23.** *Cecropia obtusifolia*, leaves and spikes (June 9, 2004). **Fig. 24.** *Acnistus arborescens*, flowers (April 13, 2004).

TABLE 1
List of plants found on the University of Costa Rica main campus

Family	Species	Location	Status	<Common local name>, comments, (butterfly species)
PTERIDOPHYTA				
Cyatheaceae	<i>Cyathea</i> sp.	ng	non.	<helecho>, cultivated tree fern from lowland
Davalliaceae	<i>Nephrolepis</i> cf. <i>biserrata</i> (Sw.) Schott	ca	nat.	<helecho>, epiphytic fern
Davalliaceae	<i>Nephrolepis</i> cf. <i>rivularis</i> (Vahl) Mett. ex Krug	ng	nat.	<helecho>, terrestrial or epiphytic fern
Dennstaedtiaceae	<i>Dennstaedtia</i> sp.	LO	nat.	<helecho>, uncommon terrestrial fern
Lomariopsidaceae	<i>Elaphoglossum</i> sp.	ca, LO	nat.	<helecho>, epiphytic fern
Polypodiaceae	<i>Phlebodium pseudoaureum</i> (Cav.) Lellinger	ca	nat.	<helecho>, epiphytic fern
Polypodiaceae	<i>Pleopeltis</i> sp.	ca, LO	nat.	small epiphytic fern
Polypodiaceae	<i>Polypodium</i> sp.	ca	nat.	<helecho>, epiphytic fern
Pteridaceae	<i>Adiantum</i> sp.	ca*, ng	nat.	<helecho>, terrestrial fern
Pteridaceae	<i>Pityrogramma calomelanos</i> (L.) Link	ng	nat.	<helecho>, terrestrial fern
-----	approx. 5 undetermined species	ca, LO	nat.	<helecho>, herbaceous species
SPERMATOPHYTA				
Gymnospermae				
Araucariaceae	<i>Araucaria cunninghamii</i> Aiton ex D. Don	ca, LO	exo.	<araucaria>, Australian tree species
Araucariaceae	<i>Araucaria excelsa</i> (Lamb.) R. Br.	ca	exo.	<araucaria>, tree species from Norfolk Islands, Australia
Cupressaceae	<i>Chamaecyparis</i> sp.	ca	exo.	<ciprés>, tree species of unknown origin
Cupressaceae	<i>Cupressus lusitanica</i> Mill.	ca	exo.	<ciprés>, Mexican tree species
Cycadaceae	<i>Cycas revoluta</i> Thunb.	ca, ng	exo.	<cica>, Southeast Asian ornamental shrub
Pinaceae	<i>Pinus caribaea</i> Morelet	ca	exo.	<pino>, Northern Central American tree
Pinaceae	<i>Pinus oocarpa</i> Schiede ex Schltdl.	ca	exo.	<pino>, Northern Central American tree
Podocarpaceae	<i>Podocarpus macrophyllus</i> (Thunb.) Sweet	ca	exo.	East Asian ornamental tree
Taxodiaceae	<i>Taxodium mucronatum</i> Ten.	ca	exo.	<ahuehuete>, Mexican ornamental tree
Zamiaceae	<i>Zamia neurophyllidia</i> D.W. Stev.	ng	non.	<zamia>, introduced from lowland
Angiospermae				
Liliopsida				
Agavaceae	<i>Agave americana</i> L.	ca	exo.	<agave>, large Mexican ornamental herb
Agavaceae	<i>Agave attenuata</i> Salm-Dyck	ca	exo.	<agave>, large Mexican ornamental herb
Agavaceae	<i>Furcraea cabuya</i> Trel.	ca	non.	<cabuya>, introduced from highland
Agavaceae	<i>Yucca guatemalensis</i> hort. ex Baker	ca, LO	exo.	<itabo>, Northern Central American giant herb
Amaryllidaceae	<i>Crinum x powellii</i> hort. ex Baker	ca, ng	exo.	<lirio de mayo>, African ornamental herb
Araceae	<i>Alocasia</i> sp.	ng	exo.	cultivated ornamental herb, probably Asian
Araceae	<i>Anthurium andraeanum</i> Linden	ng	exo.	<anturio>, South American ornamental herb
Araceae	<i>Anthurium salvinii</i> Hemsl.	ca	nat.	<tabacón>, large ornamental herb
Araceae	<i>Anthurium</i> sp. 1	ng	nat.	<anturio>, ornamental herb
Araceae	<i>Anthurium</i> sp. 2	ng	nat.	<anturio>, ornamental herb
Araceae	<i>Colocasia esculenta</i> (L.) Schott	ca, LO	exo.	<ñampi>, tropical Asian crop and ornamental herb
Araceae	<i>Dieffenbachia oerstedii</i> Schott	LO	nat.	<lotería, sainillo>, ornamental herb
Araceae	<i>Dieffenbachia</i> sp. 1	LO	nat.	<lotería>, ornamental herb
Araceae	<i>Dieffenbachia</i> sp. 2	LO	nat.	<lotería>, ornamental herb
Araceae	<i>Epipremnum aureum</i> (Linden & André) G.S. Bunting	ng	exo.	ornamental climber from Solomon Islands, Southeast Asia
Araceae	<i>Monstera adansonii</i> Schott	LO*, ng	nat.	common climber
Araceae	<i>Monstera deliciosa</i> Liebm.	ca, LO, ng	nat.	<piñanona>, robust, terrestrial or epiphytic herb
Araceae	<i>Philodendron bipinnatifidum</i> Schott ex Endl.	ca	exo.	South American climber
Araceae	<i>Philodendron</i> sp. 1	LO	nat.	climber
Araceae	<i>Philodendron</i> sp. 1	ng	nat.	climber
Araceae	<i>Philodendron</i> sp. 2	ng	nat.	climber
Araceae	<i>Philodendron</i> sp. 3	ng	nat.	climber
Araceae	<i>Philodendron</i> sp. 4	ng	nat.	climber
Araceae	<i>Spathiphyllum</i> sp.	ng	nat.	terrestrial ornamental herb
Araceae	<i>Syngonium</i> sp.	LO, ng	nat.	herbaceous climber

TABLE 1 (Continued)
List of plants found on the University of Costa Rica main campus

Family	Species	Location	Status	<Common local name>, comments, (butterfly species)
Araceae	<i>Xanthosoma undipes</i> (K. Koch & C.D. Bouché) K. Koch	ca	nat.	<tiquisque>, uncommon robust herb
Araceae	<i>Xanthosoma violaceum</i> Schott	ca, LO	nat.	<tiquisque>, occasional herb in open places
Araceae	<i>Xanthosoma wendlandii</i> (Schott) Schott	LO	nat.	<comida de culebra>, occasional herb in open places
Arecaceae	<i>Bactris gasipaes</i> Kunth	ca	non.	<pejibaye>, introduced from lowland
Arecaceae	<i>Caryota urens</i> L.	ca	exo.	<palma cola de pez>, Southeast Asian palm
Arecaceae	<i>Chamaedorea costaricana</i> Oerst.	ca, LO*, ng	nat.	<pacaya>, understory palm, probably needs control in LO, (Fig. 14) (<i>Synale cynaxa</i>)
Arecaceae	<i>Dypsis lutescens</i> (H. Wendl.) Beentje & J. Dransf.	ca, ng	exo.	<areca>, Madagascan ornamental palm
Arecaceae	<i>Elaeis guineensis</i> Jacq.	ca	exo.	<palma aceitera>, tropical African oil palm
Arecaceae	<i>Licuala grandis</i> H. Wendl. ex Linden	ca	exo.	<licuala>, ornamental palm from Southeast Asian islands
Arecaceae	<i>Livistona</i> cf. <i>chinensis</i> (Jacq.) R. Br. ex Mart.	ca, ng	exo.	Chinese ornamental palm
Arecaceae	<i>Phoenix roebelenii</i> O'Brien	ca, ng	exo.	Southeast Asian ornamental palm
Arecaceae	<i>Pinanga kuhlii</i> Blume	ca, ng	exo.	Indonesian ornamental palm
Arecaceae	<i>Rhapis excelsa</i> (Thunb.) A. Henry ex Rehder	ca, ng	exo.	East Asian ornamental palm
Arecaceae	<i>Roystonea oleracea</i> (Jacq.) O.F. Cook	ca	exo.	<palma real>, Caribbean large palm
Arecaceae	<i>Roystonea regia</i> (Kunth) O.F. Cook	ca	exo.	<palma real>, Caribbean large palm
Arecaceae	<i>Syagrus romanzoffiana</i> (Cham.) Glassman	ca, LO	exo.	<chirivá>, South American palm
Arecaceae	<i>Veitchia merrillii</i> (Becc.) H.E. Moore	ca	exo.	<palma de Manila>, Philippine ornamental palm
Arecaceae	<i>Veitchia</i> sp.	ca, ng	exo.	Southeast Asian ornamental palm
Asparagaceae	<i>Asparagus</i> sp.	ng	exo.	<espárrago>, ornamental herb from the Old World
Asteliaceae	<i>Cordyline fruticosa</i> (L.) A. Chev.	ca, ng	exo.	<caña de India>, Asian ornamental shrub
Bromeliaceae	<i>Aechmea</i> sp.	ng	nat.	<bromelia>, ornamental herb
Bromeliaceae	<i>Ananas</i> sp.	ng	exo.	<piñuela>, South American ornamental herb
Bromeliaceae	<i>Neoregelia</i> sp.	ng	exo.	<piñuela>, South American ornamental herb
Bromeliaceae	<i>Tillandsia juncea</i> (Ruiz & Pav.) Poir.	ca*, LO	nat.	<piñuela>, epiphytic herb
Bromeliaceae	<i>Tillandsia</i> sp.	ca, LO	nat.	<piñuela>, epiphytic herb
Bromeliaceae	<i>Vriesea</i> sp.?	ng	nat.	<piñuela>, ornamental herb
Cannaceae	<i>Canna</i> sp.	ca, ng	non.	<platanilla>, ornamental hybrids from lowland
Commelinaceae	<i>Commelina diffusa</i> Burm.f.	ca, LO, ng	nat.	small herb in open and wet places
Commelinaceae	<i>Tinantia erecta</i> (Jacq.) Schltldl.	LO, ng	nat.	occasional herb in open places
Commelinaceae	<i>Tradescantia spathacea</i> Sw.	ca, ng	exo.	<pluma de Venus>, Northern Central American ornamental herb
Commelinaceae	<i>Tradescantia zanonii</i> (L.) Sw.	ca, LO*	nat.	common 1.0 to 2.0 m tall herb
Commelinaceae	<i>Tradescantia zebrina</i> hort. ex Heynh.	ca, LO	nat.	<hoja del milagro>, herbaceous climber
Convallariaceae	<i>Ophiopogon jaburan</i> (Sieb.) Lodd.	ca, ng	exo.	East Asian small ornamental herb
Costaceae	<i>Costus</i> cf. <i>montanus</i> Maas	ng	nat.	<caña agria>, occasional ornamental herb
Costaceae	<i>Costus pulverulentus</i> C. Presl	ca, LO	nat.	<caña agria>, large herb visited by hummingbird, (Fig. 15)
Costaceae	<i>Costus speciosus</i> (J. König) Sm.	ca	exo.	Southeast Asian large ornamental herb
Cyclanthaceae	<i>Asplundia</i> sp.	ng	non.	introduced herb from lowland
Cyperaceae	<i>Cyperus involucratus</i> Rottb.	ca, LO, ng	exo.	common African naturalized ornamental herb
Cyperaceae	<i>Cyperus tenuis</i> Sw.	ca, LO	nat.	small herb in open places
Cyperaceae	<i>Rhynchospora nervosa</i> (Vahl) Boeck.	ca	nat.	small herb in open places
Dracaenaceae	<i>Dracaena deremensis</i> Engl.	ca, LO, ng	exo.	<caña india>, African ornamental shrub
Dracaenaceae	<i>Dracaena fragrans</i> (L.) Ker Gawl.	ca, LO, ng	exo.	<caña india>, tropical African ornamental shrub
Dracaenaceae	<i>Dracaena marginata</i> Lam.	ca, ng	exo.	<marginata>, African ornamental shrub
Dracaenaceae	<i>Dracaena</i> sp.	ng	exo.	cultivated ornamental shrub

TABLE 1 (Continued)
List of plants found on the University of Costa Rica main campus

Family	Species	Location	Status	<Common local name>, comments, (butterfly species)
Dracaenaceae	<i>Sansevieria trifasciata</i> Prain	ca, LO	exo.	<lengua de suegra>, African ornamental herb
Heliconiaceae	<i>Heliconia latispatha</i> Benth.	LO	non.	<heliconia>, introduced large herb from lowland
Heliconiaceae	<i>Heliconia metallica</i> Planch. & Linden ex Hook.	LO	non.	<heliconia>, cultivated ornamental herb
Heliconiaceae	<i>Heliconia</i> cf. <i>pogonantha</i> Cufod.	ng	non.	<heliconia>, introduced herb from lowland
Heliconiaceae	<i>Heliconia psittacorum</i> L.f.	ca	exo.	<avecilla>, ornamental herb from Northern South America
Heliconiaceae	<i>Heliconia tortuosa</i> Griggs	ca, LO	nat.	<heliconia>, large ornamental herb
Hypoxidaceae	<i>Hypoxis</i> sp.	ca	nat.	small weed in open places
Hypoxidaceae	<i>Molineria capitulata</i> (Lour.) Herb.	ca, LO, ng	exo.	<coquillo>, introduced herb from Southeast Asia
Iridaceae	<i>Crocoshia x crocosmiiflora</i> (Lemoine) N.E. Br.	LO	exo.	<chispa>, introduced herb from highland, of African origin
Iridaceae	<i>Neomarica</i> sp.	ca, ng	exo.	<lirio caminante>, South American ornamental herb
Iridaceae	<i>Sisyrinchium micranthum</i> Cav.	ca	nat.	small herb in wet and open places
Iridaceae	<i>Tigridia pavonia</i> (L.) DC.	ca	exo.	<lirio>, Mexican ornamental herb
Liliaceae	<i>Chlorophytum comosum</i> (Thunb.) Jacques	ca, ng	exo.	<mala madre>, South African ornamental herb
Liliaceae	<i>Hemerocallis fulva</i> (L.) L.	ca	exo.	<lirio>, Asian ornamental herb
Liliaceae	<i>Hemerocallis lilio-asphodelus</i> L.	ca	exo.	<lirio amarillo>, Asian ornamental herb
Liliaceae	<i>Tulbaghia violacea</i> Harv.	ca	exo.	<ajillo>, South African ornamental herb
Marantaceae	<i>Calathea crotalifera</i> S. Watson	LO	nat.	<platanilla>, occasional large ornamental herb
Marantaceae	<i>Ctenanthe</i> cf. <i>oppenheimiana</i> (E. Morren) K. Schum.	ca, ng	exo.	South American ornamental herb
Marantaceae	<i>Ctenanthe</i> sp. 1	ng	exo.	<platanilla>, South American ornamental herb
Marantaceae	<i>Ctenanthe</i> sp. 2	ng	exo.	<platanilla>, South American ornamental herb
Marantaceae	<i>Ctenanthe</i> sp. 3	ng	exo.	<platanilla>, South American ornamental herb
Marantaceae	<i>Ctenanthe</i> sp. 4	ng	exo.	<platanilla>, South American ornamental herb
Marantaceae	<i>Stromanthe stromanthoides</i> (J.F. Macbr.) L. Andersson	ca	exo.	South American ornamental herb
Marantaceae	<i>Stromanthe</i> sp.?	ca, ng	exo.	cultivated ornamental herb, probably South American
Musaceae	<i>Musa coccinea</i> Andrews	ca	exo.	<bananito>, Asian ornamental large herb
Musaceae	<i>Musa</i> sp.	ca, LO	exo.	<guineo, banano>, tropical Old World cultivated hybrids
Orchidaceae	<i>Campylocentrum micranthum</i> (Lindl.) Rolfe	ca	nat.	epiphytic herb
Orchidaceae	<i>Epidendrum barbeyanum</i> Kraenzl.	ca, LO	nat.	epiphytic herb
Orchidaceae	<i>Govenia</i> cf. <i>lilacea</i> (Lex.) Lindl.	ca, LO	nat.	terrestrial herb in open protected places
Orchidaceae	<i>Habenaria monorrhiza</i> (Sw.) Rchb.f.	ca	nat.	terrestrial herb in open protected places
Orchidaceae	<i>Prosthechea livida</i> (Lindl.) W.E. Higgins	ca	nat.	epiphytic herb
Orchidaceae	<i>Scaphyglottis micrantha</i> (Lindl.) Ames & Correll	ca, LO	nat.	epiphytic herb on trees and palms
Pandanaceae	<i>Pandanus</i> sp.	ca	exo.	Old World large ornamental herb
Poaceae	<i>Arundo donax</i> L.	ca	exo.	Mediterranean ornamental cane
Poaceae	<i>Bambusa textilis</i> McClure	ca	exo.	<bambú>, Chinese ornamental bamboo
Poaceae	<i>Bambusa vulgaris</i> Schrad. ex J.C. Wendl.	ca, LO	exo.	<bambú amarillo>, tropical Asian bamboo, (<i>Perichares deceptus</i> ; <i>P. lotus</i> ; <i>Manataria maculata</i> , captive, Murillo & Nishida 2003)
Poaceae	<i>Chusquea pittieri</i> Hack.	ca	non.	<bambú>, introduced from highland
Poaceae	<i>Coix lacryma-jobi</i> L.	ca	exo.	<lágrimas de San Pedro>, naturalized tropical Asian grass
Poaceae	<i>Cynodon</i> sp.	ca	exo.	<grama>, common African grass
Poaceae	<i>Digitaria</i> sp.	ca	nat.	common grass in open places

TABLE 1 (Continued)
List of plants found on the University of Costa Rica main campus

Family	Species	Location	Status	<Common local name>, comments, (butterfly species)
Poaceae	<i>Guadua angustifolia</i> Kunth	LO	non.	<bambú>, bamboo probably cultivated from lowland, (<i>Manataria maculata</i> , captive, Murillo & Nishida 2003; <i>Oxeoschistus taupopolis</i> ; <i>Pedaliodes dejecta</i> ; <i>P. manis</i>)
Poaceae	<i>Lasiacis</i> sp.	LO	nat.	pseudo-bambusoid grass
Poaceae	<i>Oplismenus burmannii</i> (Retz.) P. Beauv.	ca, LO	nat.	<zacate de ratón>, common grass
Poaceae	<i>Pennisetum purpureum</i> Schumach.	LO	exo.	<pasto de elefante>, African grass
Poaceae	<i>Phyllostachys aurea</i> Carrière ex Rivière & C. Rivière	ca	exo.	<bambú>, Chinese ornamental bamboo
Poaceae	<i>Pseudosasa japonica</i> Makino ex Nakai	ca	exo.	<bambú>, Japanese ornamental bamboo
Smilacaceae	<i>Smilax mollis</i> Humb. & Bonpl. ex Willd.	LO	nat.	<zarzaparrilla>, occasional climber
Strelitziaceae	<i>Ravenala madagascariensis</i> Sonn.	ca	exo.	<palma del viajero>, Madagascan ornamental
Zingiberaceae	<i>Alpinia purpurata</i> (Vieill.) K. Schum.	ca, ng	exo.	<antorcha>, Southeast Asian large ornamental herb
Zingiberaceae	<i>Etlingera elatior</i> (Jack) R.M. Sm.	ca, ng	exo.	<bastón de emperador>, Malaysian large ornamental herb
Zingiberaceae	<i>Hedychium coccineum</i> Buch. Ham. ex Sm.	ca, LO, ng	exo.	East Asian ornamental herb
Zingiberaceae	<i>Hedychium coronarium</i> J. König	LO	exo.	<heliotropo blanco>, East Asian naturalized herb
Magnoliopsida				
Acanthaceae	<i>Blechum pyramidatum</i> (Lam.) Urb.	ca, LO	nat.	<sornia>, small herb in open places
Acanthaceae	<i>Graptophyllum pictum</i> (L.) Griff.	ca	exo.	ornamental shrub from Southeast Asian islands
Acanthaceae	<i>Hygrophila costata</i> Nees	LO	nat.	uncommon herb on river bank
Acanthaceae	<i>Hypoestes phyllostachya</i> Baker	ca	exo.	<sarampión>, naturalized tropical African herb
Acanthaceae	<i>Justicia aurea</i> Schltldl.	LO	nat.	secondary growth shrub
Acanthaceae	<i>Megaskepasma erythroclamys</i> Lindau	ca, LO	exo.	<pavón rojo>, South American naturalized shrub
Acanthaceae	<i>Odontonema tubiforme</i> (Bertol.) Kuntze	ca*, LO	nat.	<espiga de fuego>, common shrub at edges of river
Acanthaceae	<i>Pachystachys lutea</i> Nees	ca, ng	exo.	<camarón>, South American ornamental shrub
Acanthaceae	<i>Pseuderanthemum cuspidatum</i> (Nees) Radlk.	ca, LO*	nat.	invasive annual herb in open places, Fig. 16, (<i>Bolla oiclus imbras</i> ; <i>Siproeta epaphus</i>)
Acanthaceae	<i>Sanchezia parvibracteata</i> Sprague & Hutch.	ca	exo.	Northern South American ornamental
Acanthaceae	<i>Thunbergia erecta</i> (Benth.) T. Anderson	ca, LO	exo.	<teléfono>, African ornamental shrub
Amaranthaceae	<i>Achyranthes aspera</i> L.	ca, LO*	nat.	annual herb in open places
Amaranthaceae	<i>Alternanthera amoena</i> Back. & Sloot.	ca, ng	exo.	ornamental herb of uncertain origin
Amaranthaceae	<i>Alternanthera</i> sp.	LO	nat.	young secondary growth herb
Amaranthaceae	<i>Iresine diffusa</i> Humb. & Bonpl. ex Willd.	ca, LO*	nat.	common herb in open places
Anacardiaceae	<i>Anacardium excelsum</i> (Kunth) Skeels	ca, LO	non.	<espavel>, introduced tree from lowland
Anacardiaceae	<i>Astronium graveolens</i> Jacq.	ca, LO	non.	<ronrón>, young cultivated trees from lowland
Anacardiaceae	<i>Mangifera indica</i> L.	ca, LO	exo.	<mango>, Southeast Asian naturalized tree
Anacardiaceae	<i>Mauria heterophylla</i> Kunth	ca	nat.	<lantisco>, tree species
Anacardiaceae	<i>Schinus molle</i> L.	ca	exo.	<pirul>, South American ornamental tree
Anacardiaceae	<i>Spondias purpurea</i> L.	ca, LO	non.	<jocote>, cultivated from lowland
Anacardiaceae	<i>Tapirira mexicana</i> Marchand	ca, LO	nat.	<ciruelo de monte>, tree species
Annonaceae	<i>Annona cherimola</i> Mill.	ca, LO	nat.	<anona>, occasional tree (<i>Atarnes sallei</i> ; <i>Oenomaus ortygnus</i> , fruit; <i>Catocyclotis adelina</i> , captive)
Annonaceae	<i>Cananga odorata</i> (Lam.) Hook.f. & Thomson	ca	exo.	<ilán-ilán>, Southeast Asian tree
Annonaceae	<i>Guatteria</i> sp.	LO	non.	introduced from lowland
Annonaceae	<i>Rollinia</i> sp.	ca	non.	introduced from lowland
Apiaceae	<i>Cyclospermum leptophyllum</i> (Pers.) Sprague	ca	nat.	<culantrillo>, common herb in open places
Apiaceae	<i>Eryngium carlinae</i> F. Delaroché	ca	nat.	<achicoria>, common herb in sunny places
Apiaceae	<i>Eryngium foetidum</i> L.	ca	nat.	<culantro de coyote>, occasional herb

TABLE 1 (Continued)
List of plants found on the University of Costa Rica main campus

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Apiaceae	<i>Hydrocotyle bowlesioides</i> Mathias & Constance	ca	nat.	small herb in open places
Apiaceae	<i>Hydrocotyle umbellata</i> L.	ca, ng	nat.	<comalillo>, herb in wet and open places
Apocynaceae	<i>Allamanda cathartica</i> L.	ca, ng	non.	<bejuco de San José>, cultivated from lowland
Apocynaceae	<i>Nerium oleander</i> L.	ca, ng	exo.	<adelfa>, South European ornamental shrub
Apocynaceae	<i>Stemmadenia litoralis</i> (Kunth) L. Allorge	LO	nat.	<huevos de caballo>, tree species
Apocynaceae	<i>Thevetia peruviana</i> (Pers.) K. Schum.	ca, ng	exo.	<chirca>, South American ornamental tree
Araliaceae	<i>Dizygotheca elegantissima</i> (Veitch ex Mast.) R. Vig. & Guillaumin	ca	exo.	Southeast Pacific ornamental tree
Araliaceae	<i>Hedera helix</i> L.	ca	exo.	<hiedra>, European ornamental climber
Araliaceae	<i>Oreopanax xalapensis</i> (Kunth) Decne. & Planch.	ca, LO	nat.	<cacho de venado>, native tree to the study area
Araliaceae	<i>Polyscias fruticosa</i> (L.) Harms	ca	exo.	Southeast Pacific ornamental shrub
Araliaceae	<i>Polyscias guilfoylei</i> (W. Bull) L.H. Bailey	ca	exo.	<remiendo de pobre>, Polynesian ornamental shrub
Araliaceae	<i>Schefflera</i> sp. 1	ca, ng	exo.	<cheflera>, ornamental shrub, origin unknown
Araliaceae	<i>Schefflera</i> sp. 2	ng	exo.	ornamental shrub, origin unknown
Araliaceae	<i>Tetrapanax papyrifer</i> (Hook.) K. Koch	ca, LO	exo.	Chinese treelet species
Aristolochiaceae	<i>Aristolochia grandiflora</i> Sw.	ca, LO*	nat.	<aristolochia>, climber with large flowers, Fig. 19
Aristolochiaceae	<i>Aristolochia ringens</i> Vahl	ca	exo.	Brazilian cultivated climber
Asclepiadaceae	<i>Asclepias curassavica</i> L.	ca	nat.	<viborana>, small shrub in open places
Asclepiadaceae	<i>Gonolobus</i> cf. <i>edulis</i> Hemsl.	ca, LO	nat.	<cuayote>, herbaceous climber
Asteraceae	<i>Acmella oppositifolia</i> (Lam.) R.K. Jansen	ca	nat.	small weed in open places
Asteraceae	<i>Baccharis pedunculata</i> (Mill.) Cabrera	ca	nat.	<manzana de pobre>, secondary growth shrub
Asteraceae	<i>Bidens pilosa</i> L.	ca, LO	nat.	<muriseco>, common weed
Asteraceae	<i>Bidens reptans</i> (L.) G. Don	LO	nat.	occasional secondary growth climber
Asteraceae	<i>Chaptalia nutans</i> (L.) Pol.	ca	nat.	<árnica>, small weed in open places
Asteraceae	<i>Chromolaena</i> sp.	LO	nat.	secondary growth shrub
Asteraceae	<i>Conyza apurensis</i> Kunth	ca	nat.	weed in open places
Asteraceae	<i>Conyza canadensis</i> (L.) Cronquist	ca	nat.	weed in open places
Asteraceae	<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	ca, LO, ng	exo.	newly introduced invasive African weed
Asteraceae	<i>Critonia morifolia</i> (Mill.) R.M. King & H. Rob.	LO	nat.	secondary growth shrub
Asteraceae	<i>Dahlia</i> cf. <i>imperialis</i> Roelz ex Ortgies	LO	nat.	secondary growth shrub
Asteraceae	<i>Delilia biflora</i> (L.) Kuntze	LO, ng	nat.	<lentejas>, weed in open places
Asteraceae	<i>Emilia fosbergii</i> Nicolson	ca, ng	nat.	<clavelillo>, small weed in open places
Asteraceae	<i>Helianthus annuus</i> L.	ca	exo.	<girasol>, North American ornamental
Asteraceae	<i>Jaegeria hirta</i> (Lag.) Less.	ca	nat.	<mielcilla>, common small herb
Asteraceae	<i>Koanophyllum</i> sp.	LO	nat.	secondary growth shrub
Asteraceae	<i>Lasianthaea fruticosa</i> (L.) K.M. Becker	LO	nat.	<mirasol>, secondary growth shrub
Asteraceae	<i>Melampodium costaricense</i> Stuessy	ca, LO	nat.	weed in open places
Asteraceae	<i>Melampodium perfoliatum</i> (Cav.) Kunth	ca, LO	nat.	weed in open places
Asteraceae	<i>Melanthera nivea</i> (L.) Small	ca, LO	nat.	<botón blanco>, weed in open places
Asteraceae	<i>Mikania micrantha</i> Kunth	ca, LO	nat.	<guaco>, herbaceous climber
Asteraceae	<i>Montanoa atriplicifolia</i> (Pers.) Sch. Bip.	LO	nat.	secondary growth herb
Asteraceae	<i>Montanoa hibiscifolia</i> Benth.	ca, LO*	nat.	<tora>, common secondary growth shrub
Asteraceae	<i>Podachaenium eminens</i> (Lag.) Baill.	LO	nat.	secondary growth shrub
Asteraceae	<i>Pseudelephantopus spicatus</i> (Juss.) Vahl	ca, ng	nat.	weed in open places
Asteraceae	<i>Pseudogyneria chenopodioides</i> (Kunth) Cabrera	ca	non.	<dalia trepadora>, cultivated climber from highland
Asteraceae	<i>Sonchus oleraceus</i> L.	ca	exo.	<lechuguilla>, Eurasian weed in open places
Asteraceae	<i>Synedrella nodiflora</i> (L.) Gaertn.	ca, LO, ng	nat.	<espínillo>, small weed in open places
Asteraceae	<i>Verbesina turbacensis</i> Kunth	ca, LO, ng	nat.	<túete>, secondary growth small shrub
Asteraceae	<i>Vernonia patens</i> Kunth	ca, LO	nat.	<tora>, common secondary growth shrub
Asteraceae	<i>Vernonia triflosculosa</i> Kunth	ca, LO	nat.	secondary growth small tree

TABLE 1 (Continued)
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Asteraceae	<i>Youngia japonica</i> (L.) DC.	ca	exo.	common Southeast Asian herb in open places
Balsaminaceae	<i>Impatiens walleriana</i> Hook. f.	ca, LO*, ng	exo.	<china>, tropical African invasive weed
Basellaceae	<i>Anredera cordifolia</i> (Ten.) Steenis	ca, LO	exo.	<moquillo>, subtropical South American herbaceous climber
Begoniaceae	<i>Begonia</i> sp.	ng	exo.	<begonia>, cultivated ornamental herb
Berberidaceae	<i>Nandina domestica</i> Thunb.	ca, ng	exo.	East Asian ornamental shrub
Bignoniaceae	<i>Cybistax donnell-smithii</i> (Rose) Seibert	ca, ng	exo.	<primavera>, Mexican ornamental tree
Bignoniaceae	<i>Jacaranda mimosifolia</i> D. Don	ca	exo.	<jacaranda>, South American tree
Bignoniaceae	<i>Parmentiera aculeata</i> (Kunth) Seem.	ca, LO	non.	introduced from lowland
Bignoniaceae	<i>Pyrostegia venusta</i> (Ker Gawl.) Miers	ca	exo.	<triquitracue>, South American ornamental climber
Bignoniaceae	<i>Spathodea campanulata</i> P. Beauv.	ca, ng	exo.	<llama del bosque>, African tree
Bignoniaceae	<i>Tabebuia</i> cf. <i>impetiginosa</i> (Mart. ex DC.) Standl.	ca, LO	non.	<cortez morado>, cultivated from lowland
Bignoniaceae	<i>Tabebuia rosea</i> (Bertol.) A. DC.	ca*, LO, ng	non.	<roble de sabana>, frequently planted ornamental tree from lowland
Bignoniaceae	<i>Tecoma stans</i> (L.) Juss. ex Kunth	ca	non.	<vainillo>, introduced from lowland
Bignoniaceae	<i>Tourretia lappacea</i> (L'Hér.) Willd.	LO	nat.	uncommon herbaceous climber
Bombacaceae	<i>Ceiba pentandra</i> (L.) Gaertn.	ca, LO	non.	<ceiba>, introduced from lowland
Bombacaceae	<i>Ochroma pyramidale</i> (Cav. ex Lam.) Urb.	ca, LO	non.	<balsa>, introduced from lowland
Bombacaceae	<i>Pachira aquatica</i> Aubl.	ca, LO	non.	introduced from lowland
Bombacaceae	<i>Pachira quinata</i> (Jacq.) W.S. Alverson	ca, LO	non.	<pochote>, introduced from lowland
Boraginaceae	<i>Cordia eriotigma</i> Pittier	ca, LO*	nat.	<muñeco>, tree species
Boraginaceae	<i>Tournefortia glabra</i> L.	LO	nat.	secondary growth shrub
Brassicaceae	<i>Lepidium virginicum</i> L.	ca	nat.	<mastuerzo>, annual weed in open places
Cactaceae	<i>Acanthocereus pentagonus</i> (L.) Britton & Rose	ca, ng	non.	<cacto>, columnar cactus introduced from lowland
Cactaceae	<i>Hylocereus costaricensis</i> (F.A.C. Weber) Britton	ca	nat.	<pitahaya>, epiphytic cactus
Cactaceae	<i>Opuntia</i> cf. <i>brasiliensis</i> (Willd.) Haw.	ng	exo.	<cacto>, Brazilian ornamental cactus
Caryophyllaceae	<i>Drymaria cordata</i> (L.) Willd. ex Schult.	ca, LO, ng	nat.	small weed in open places
Casuarinaceae	<i>Casuarina equisetifolia</i> J.R. Forst.	ca	exo.	<pino de Australia>, Australian tree
Cecropiaceae	<i>Cecropia obtusifolia</i> Bertol.	ca, LO*, ng	nat.	<guarumo>, secondary growth pioneer tree, Fig. 23, (<i>Historis odius</i>)
Clusiaceae	<i>Calophyllum brasiliense</i> Cambess.	LO	non.	<cedro maria>, cultivated from lowland
Clusiaceae	<i>Garcinia</i> cf. <i>dulcis</i> (Roxb.) Kurz	ca	exo.	<mangostán amarillo>, Southeast Asian tree
Clusiaceae	<i>Garcinia intermedia</i> (Pittier) Hammel	LO	nat.	<jorco>, tree species
Combretaceae	<i>Terminalia amazonia</i> (J.F. Gmel.) Exell	LO	non.	cultivated from lowland
Convolvulaceae	<i>Ipomoea alba</i> L.	ca	nat.	<churrístate>, herbaceous climber
Convolvulaceae	<i>Ipomoea neei</i> (Spreng.) O'Donell	ca, LO*	nat.	<churrístate>, herbaceous climber
Convolvulaceae	<i>Ipomoea santillanii</i> O'Donell	LO*	nat.	<churrístate>, herbaceous climber
Convolvulaceae	<i>Ipomoea</i> sp.	ca	nat.	<churrístate>, herbaceous climber
Cucurbitaceae	<i>Cucurbita</i> sp.	ca	exo.	<ayote>, creeping crop species
Cucurbitaceae	<i>Rytidostylis gracilis</i> Hook. & Arn.	ca, ng	nat.	<chanchito>, herbaceous climber
Cucurbitaceae	<i>Sechium edule</i> (Jacq.) Sw.	LO	non.	<chayote>, cultivated climber, (from highland?)
Euphorbiaceae	<i>Acalypha hispida</i> Burm. f.	ca	exo.	<rabo de gato>, Southeast Asian ornamental shrub
Euphorbiaceae	<i>Acalypha leptopoda</i> Müll. Arg.	LO	nat.	secondary growth shrub
Euphorbiaceae	<i>Acalypha wilkesiana</i> Müll. Arg.	ca	exo.	South Pacific ornamental shrub
Euphorbiaceae	<i>Chamaesyce hirta</i> (L.) Millsp.	ca	nat.	<golondrina>, small herb in open places
Euphorbiaceae	<i>Cnidioscolus aconitifolius</i> (Mill.) I.M. Johnst.	ca	nat.	<chicasquil>, occasional tree species
Euphorbiaceae	<i>Codiaeum variegatum</i> (L.) Blume	ca, ng	exo.	<croto>, Southeast Asian ornamental shrub
Euphorbiaceae	<i>Croton draco</i> Cham. & Schldl.	ca, LO*	nat.	<targuá>, tree species
Euphorbiaceae	<i>Croton niveus</i> Jacq.	LO	nat.	<copalchí>, occasional shrub or tree

TABLE 1 (Continued)
List of plants found on the University of Costa Rica main campus

Family	Species	Location	Status	<Common local name>, comments, (butterfly species)
Euphorbiaceae	<i>Euphorbia lancifolia</i> Schldl.	ca	exo.	<ixbut>, Northern Central American medicinal herb
Euphorbiaceae	<i>Euphorbia pulcherrima</i> Willd.	ca, ng	exo.	<pastora>, Mexican ornamental shrub
Euphorbiaceae	<i>Phyllanthus niruri</i> L.	ca*, ng	nat.	<tamarindillo>, common weed in open places
Euphorbiaceae	<i>Ricinus communis</i> L.	ca, LO	exo.	<higuerilla>, African naturalized shrub
Euphorbiaceae	<i>Sapium glandulosum</i> (L.) Morong	ca*, LO*	nat.	<yos>, fast growing pioneer tree
Fabaceae/Caes.	<i>Bauhinia purpurea</i> L.	ca	exo.	<orquidea de palo>, Southeast Asian ornamental tree
Fabaceae/Caes.	<i>Caesalpinia exostemma</i> DC.	ca	non.	introduced from lowland
Fabaceae/Caes.	<i>Delonix regia</i> (Bojer) Raf.	ca	exo.	<malinche>, African tree
Fabaceae/Caes.	<i>Hymenaea courbaril</i> L.	ca	non.	<guapinol>, introduced from lowland
Fabaceae/Caes.	<i>Senna didymobotrya</i> (Fresen.) H.S. Irwin & Barneby	ca	exo.	African small ornamental tree
Fabaceae/Caes.	<i>Senna papillosa</i> (Britton & Rose) H.S. Irwin & Barneby	ca, LO	nat.	<candelillo>, tree species, Fig. 17, (<i>Eurema xanthochlora</i> ; <i>Phoebis philea</i>)
Fabaceae/Caes.	<i>Senna spectabilis</i> (DC.) H.S. Irwin & Barneby	ca	non.	<vainillo>, introduced from lowland
Fabaceae/Mim.	<i>Acacia angustissima</i> (Mill.) Kuntze	ca	nat.	<carboncillo>, shrub in open places
Fabaceae/Mim.	<i>Calliandra calothyrsus</i> Meisn.	LO	nat.	<carboncillo>, shrub in open places
Fabaceae/Mim.	<i>Cojoba arborea</i> (L.) Britton & Rose	ca*, LO, ng	non.	<lorito>, introduced from lowland
Fabaceae/Mim.	<i>Enterolobium cyclocarpum</i> (Jacq.) Griseb.	LO	non.	<guanacaste>, young trees from lowland
Fabaceae/Mim.	<i>Inga punctata</i> Willd.	ca, LO*	nat.	<guaba>, tree species
Fabaceae/Mim.	<i>Inga spectabilis</i> (Vahl) Willd.	ca	non.	<guaba machete>, introduced from lowland
Fabaceae/Mim.	<i>Inga vera</i> Willd.	LO	nat.	<guaba>, occasional tree, Fig. 20, (<i>Catocyclotis adelina</i>)
Fabaceae/Mim.	<i>Inga</i> sp.	LO	non.	<guaba>, cultivated, origin unknown
Fabaceae/Mim.	<i>Leucaena leucocephala</i> (Lam.) de Wit	LO	non.	<ipil-ipil>, introduced from lowland
Fabaceae/Mim.	<i>Lysiloma divaricatum</i> (Jacq.) J.F. Macbr.	ca	non.	introduced from lowland
Fabaceae/Mim.	<i>Samanea saman</i> (Jacq.) Merr.	ca, LO	non.	<cenizaro>, introduced from lowland
Fabaceae/Mim.	<i>Zapoteca tetragona</i> (Willd.) H.M. Hern.	ca	nat.	shrub in open places
Fabaceae/Mim.	<i>Zygia longifolia</i> (Humb. & Bonpl. ex Willd.) Britton & Rose	ca	non.	<sotacaballo>, introduced from lowland
Fabaceae/Pap.	<i>Arachis pintoii</i> Krapov. & W.C. Gregory	ca	exo.	<manicillo>, Brazilian ornamental herb
Fabaceae/Pap.	<i>Cajanus cajan</i> (L.) Millsp.	ca	exo.	<frijol de palo>, African or Asian bean shrub
Fabaceae/Pap.	<i>Dalbergia retusa</i> Hemsl.	LO	non.	<cocobola>, introduced from lowland
Fabaceae/Pap.	<i>Diphysa americana</i> (Mill.) M. Sousa	ca, LO, ng	nat.	<guachipelin>, native ornamental tree
Fabaceae/Pap.	<i>Erythrina abyssinica</i> Lam. ex DC.	ca	exo.	African ornamental tree
Fabaceae/Pap.	<i>Erythrina crista-galli</i> L.	ca	exo.	<árbol de coral>, South American ornamental tree
Fabaceae/Pap.	<i>Erythrina poeppigiana</i> (Walp.) O.F. Cook	ca, LO*, ng	exo.	<poró gigante>, invasive tree species from Northern South America (<i>Astraptes alardus</i>)
Fabaceae/Pap.	<i>Lonchocarpus</i> cf. <i>oliganthus</i> F. J. Herm.	ca, LO*	nat.	<chaperno>, common tree species
Fabaceae/Pap.	<i>Lonchocarpus costaricensis</i> (Donn. Sm.) Pittier	ca	non.	<chaperno>, introduced from lowland
Fabaceae/Pap.	<i>Myroxylon balsamum</i> (L.) Harms	ca, ng	non.	<chirraca>, introduced from lowland
Fabaceae/Pap.	<i>Phaseolus lunatus</i> L.	LO	nat.	<frijolillo>, herbaceous climber
Fagaceae	<i>Quercus seemannii</i> Liebm.	ca	non.	<roble>, introduced from highland
Flacourtiaceae	<i>Flacourtia inermis</i> Roxb.	ca	exo.	South Asian tree
Hamamelidaceae	<i>Liquidambar styraciflua</i> L.	ca	exo.	<liquidámbar>, North American tree
Hippocastanaceae	<i>Billia rosea</i> (Planch. & Linden) C. Ulloa & P. Jørg.	ca	non.	<cucaracho>, young cultivated trees from highland
Juglandaceae	<i>Juglans olanchana</i> Standl. & L.O. Williams	ca, LO, ng	exo.	<nogal>, Northern Central American tree beginning to be naturalized
Lamiaceae	<i>Salvia costaricensis</i> Oerst.	ca, LO	nat.	common herb in open places
Lamiaceae	<i>Salvia splendens</i> Sellow ex Wied-Neuw.	ca	exo.	<salvia roja>, Brazilian ornamental
Lamiaceae	<i>Solenostemon scutellarioides</i> (L.) Codd	ca, ng	exo.	<chirrite>, Southeast Asian ornamental

TABLE 1 (Continued)
List of plants found on the University of Costa Rica main campus

Family	Species	Location	Status	<Common local name>, comments, (butterfly species)
Lamiaceae	<i>Stachys costaricensis</i> Briq.	ca	nat.	small herb in open places
Lauraceae	<i>Cinnamomum triplinerve</i> (Ruiz & Pav.) Kosterm.	ca, LO	nat.	<aguacatillo>, tree species, formerly known as <i>C. cinnamomifolium</i> (Kunth) Kosterm., (<i>Catocyclotis adelina</i>)
Lauraceae	<i>Licaria triandra</i> (Sw.) Kosterm.	ca, LO*	nat.	<aguacatillo>, tree species
Lauraceae	<i>Persea americana</i> Mill.	ca, LO	nat.	<aguacate>, occasional tree species
Lauraceae	<i>Persea caerulea</i> (Ruiz & Pav.) Mez	ca, LO, ng	nat.	<aguacatillo ascá>, tree species
Loranthaceae	<i>Struthanthus costaricensis</i> Standl.	ca, LO	nat.	<matapalo>, parasitic sub-shrub
Loranthaceae	<i>Struthanthus marginatus</i> (Desr.) Blume	ca	nat.	<matapalo>, parasitic sub-shrub, (<i>Hesperocharis crocea</i> , captive)
Loranthaceae	<i>Struthanthus orbicularis</i> (Kunth) Blume	ca, LO	nat.	<matapalo>, parasitic sub-shrub, (<i>Hesperocharis crocea</i> ; <i>Rhetus arcus</i>)
Lythraceae	<i>Cuphea carthagenensis</i> (Jacq.) J.F. Macbr.	ca, ng	nat.	commonly cultivated ornamental sub-shrub
Lythraceae	<i>Lagerstroemia speciosa</i> (L.) Pers.	ca	exo.	<orgullo de la India>, East Asian ornamental tree
Malpighiaceae	<i>Bunchosia macrophylla</i> Rose	ca, LO	nat.	cultivated ornamental tree
Malpighiaceae	<i>Malpighia glabra</i> L.	ca, LO	nat.	<acerola>, shrub or tree species
Malpighiaceae	<i>Tetrapteryx schiedeana</i> Schltld. & Cham.	ca	nat.	woody climber
Malvaceae	<i>Hibiscus rosa-sinensis</i> L.	ca	exo.	<amapola>, East Asian ornamental shrub
Malvaceae	<i>Hibiscus</i> spp. (hybrids)	ca	exo.	<amapola>, East Asian ornamental shrubs
Malvaceae	<i>Malvaviscus penduliflorus</i> DC.	ca, LO, ng	exo.	<malvavisco>, Mexican ornamental shrub
Malvaceae	<i>Pavonia rosea</i> Schltld.	LO	nat.	small understory shrub
Malvaceae	<i>Sida rhombifolia</i> L.	ca, LO	nat.	<escobilla>, herb in open places
Melastomataceae	<i>Clidemia</i> sp.	ca	nat.	uncommon secondary growth shrub
Melastomataceae	<i>Conostegia xalapensis</i> (Bonpl.) D. Don ex DC.	ca	nat.	<lengua de vaca>, secondary growth shrub or tree
Melastomataceae	<i>Miconia calvescens</i> Schrank & Mart. ex DC.	ca, LO	non.	shrub, introduced from lowland for study purpose
Meliaceae	<i>Cedrela odorata</i> L.	ca, LO	nat.	<cedro amargo>, timber tree species
Meliaceae	<i>Cedrela tonduzii</i> C. DC.	LO	non.	<cedro dulce>, introduced from highland
Meliaceae	<i>Melia azedarach</i> L.	ca, LO	exo.	<paraíso>, East Asian tree species
Meliaceae	<i>Swietenia macrophylla</i> King	ca, LO	non.	<caoba>, introduced from lowland
Meliaceae	<i>Trichilia havanensis</i> Jacq.	ca*, LO*	nat.	<uruca>, common roadside tree in San José city, (<i>Catocyclotis adelina</i> ; <i>Emesis mandana</i>)
Menispermaceae	<i>Cissampelos pareira</i> L.	ca, LO	nat.	herbaceous climber
Moraceae	<i>Artocarpus heterophyllus</i> Lam.	ca	exo.	<jaca>, tropical Asian or Polynesian ornamental tree
Moraceae	<i>Ficus benjamina</i> L.	ca*, ng	exo.	<laurel de la India>, common Asian ornamental tree
Moraceae	<i>Ficus</i> cf. <i>citrifolia</i> Mill.	LO	nat.	<higuerón>, locally rare tree
Moraceae	<i>Ficus costaricana</i> (Liebm.) Miq.	ca*, LO	nat.	<higuerón>, common tree species
Moraceae	<i>Ficus elastica</i> Roxb.	ca	exo.	<chilamate>, East Asian tree
Moraceae	<i>Ficus jimenezii</i> Standl.	ca, LO	nat.	<chilamate, higuerón>, tree species
Moraceae	<i>Ficus pertusa</i> L.f.	ca, LO	nat.	<higuito>, epiphytic tree
Moraceae	<i>Ficus</i> cf. <i>velutina</i> Kunth	LO	non.	<higuerón>, introduced from highland
Moraceae	<i>Morus nigra</i> L.	ca	exo.	<morera>, East Asian ornamental
Myrsinaceae	<i>Ardisia revoluta</i> Kunth	ca, LO	non.	<tucuico>, introduced from lowland
Myrtaceae	<i>Callistemon lanceolatus</i> (J.E. Smith) Sweet	ca	exo.	<hisopo>, Australian shrub
Myrtaceae	<i>Eugenia</i> sp.	LO	non.	cultivated tree, origin unknown
Myrtaceae	<i>Eucalyptus</i> sp. 1	ca	exo.	<eucalipto>, Australian tree species
Myrtaceae	<i>Eucalyptus</i> sp. 2	ca	exo.	<eucalipto>, Australian tree species
Myrtaceae	<i>Eucalyptus</i> sp. 3	ca	exo.	<eucalipto>, Australian tree species
Myrtaceae	<i>Eugenia biflora</i> (L.) DC.	ca	exo.	<pitanga>, South American shrub or tree
Myrtaceae	<i>Eugenia truncata</i> O. Berg	ca, LO	non.	introduced from lowland

TABLE 1 (Continued)
List of plants found on the University of Costa Rica main campus

Family	Species	Location	Status	<Common local name>, comments, (butterfly species)
Myrtaceae	<i>Myrcianthes fragrans</i> (Sw.) McVaugh	LO	non.	introduced from highland
Myrtaceae	<i>Psidium guajava</i> L.	ca, LO	nat.	<guayabo>, tree in open places
Myrtaceae	<i>Syzygium jambos</i> (L.) Alston	ca, LO	exo.	<manzana rosa>, Southeast Asian invasive tree
Nyctaginaceae	<i>Bougainvillea glabra</i> Choisy	ca, LO	exo.	<veranera>, South American ornamental shrub
Nyctaginaceae	<i>Neea psychotrioides</i> Donn. Sm.	ca, LO	nat.	small tree with fruits eaten by many animal species
Oleaceae	<i>Fraxinus uhdei</i> (Wenz.) Lingelsh.	ca	exo.	<fresno>, North American tree
Oleaceae	<i>Ligustrum lucidum</i> Aiton	ca	exo.	<trueno>, Mediterranean tree species
Oleaceae	<i>Ligustrum vulgare</i> L.	ca	exo.	<olivo de cerca>, European shrub
Onagraceae	<i>Oenothera rosea</i> Aiton	ca	nat.	small herb in open places
Oxalidaceae	<i>Oxalis corniculata</i> L.	ca, ng	nat.	<trébol>, small herb in open places
Oxalidaceae	<i>Oxalis latifolia</i> Kunth	ca	nat.	<trébol>, small herb in open places
Passifloraceae	<i>Passiflora adenopoda</i> DC.	ca, LO, ng	nat.	<pasiflora>, herbaceous climber
Passifloraceae	<i>Passiflora biflora</i> Lam.	ca, LO, ng	nat.	<calzoncillo>, herbaceous climber, Fig. 22, (<i>Heliconius</i> spp.)
Phytolaccaceae	<i>Rivina humilis</i> L.	ca, LO*	nat.	<carmin>, common small shrub, Fig. 18
Piperaceae	<i>Peperomia</i> sp.	ca, ng	nat.	ornamental herb
Piperaceae	<i>Piper aduncum</i> L.	ca, LO	nat.	<cordoncillo>, secondary growth shrub or small tree
Piperaceae	<i>Piper bredemeyeri</i> Jacq.	LO	nat.	<cordoncillo>, secondary growth shrub
Piperaceae	<i>Piper hispidum</i> Sw.	LO	nat.	<cordoncillo>, secondary growth shrub
Piperaceae	<i>Piper umbellatum</i> L.	ca, LO*, ng	nat.	<anisillo>, secondary growth shrub
Plantaginaceae	<i>Plantago major</i> L.	ca	exo.	<lantén>, naturalized herb from the Old World
Polygonaceae	<i>Coccoloba acapulcensis</i> Standl.	ca, LO	non.	introduced from lowland
Polygonaceae	<i>Coccoloba caracasana</i> Meisn.	LO	non.	introduced from lowland
Polygonaceae	<i>Rumex crispus</i> L.	ca	exo.	<ruibarbo>, Eurasian naturalized herb in open places
Polygonaceae	<i>Rumex nepalensis</i> Spreng.	ca	exo.	<ruibarbo>, Eurasian naturalized herb in open places
Polygonaceae	<i>Triplaris melaenodendron</i> (Bertol.) Standl. & Steyerl.	LO	non.	<hormigo>, introduced from lowland
Proteaceae	<i>Grevillea robusta</i> A. Cunn.	ca	exo.	<gravilia>, Australian ornamental tree
Rhamnaceae	<i>Gouania lupuloides</i> (L.) Urb.	ca	nat.	herbaceous to woody climber
Rosaceae	<i>Eriobotrya japonica</i> (Thunb.) Lindl.	ca, LO	exo.	<níspero>, East Asian naturalized tree species
Rosaceae	<i>Prunus skutchii</i> I.M. Johnst.	ca, LO	non.	cultivated on campus, seeds dispersed probably by birds
Rosaceae	<i>Pyracantha coccinea</i> M. Roem.	ca	exo.	Southwest Asian ornamental tree
Rosaceae	<i>Rosa</i> sp.	ca	exo.	<rosa>, Old World ornamental
Rubiaceae	<i>Coffea arabica</i> L.	LO*, ng	exo.	<café>, Northern African shrub, needs control in LO
Rubiaceae	<i>Hamelia patens</i> Jacq.	ca, LO	nat.	<zorrillo real>, visited by many butterflies, Fig. 21
Rubiaceae	<i>Pentas lanceolata</i> (Forssk.) Deflers	ca, ng	exo.	East African ornamental, cultivated to attract butterflies
Rubiaceae	<i>Psychotria marginata</i> Sw.	LO	nat.	understory shrub
Rubiaceae	<i>Spermacoce</i> cf. <i>assurgens</i> Ruiz & Pav.	ca, ng	nat.	herb in open places
Rutaceae	<i>Citrus</i> sp. 1	ca, LO	exo.	<naranja, limón>, Old World naturalized tree, (<i>Achlyodes pallida</i>)
Rutaceae	<i>Citrus</i> sp. 2	ng	exo.	<naranja, limón>, Old World naturalized tree
Rutaceae	<i>Citrus</i> sp. 3	ng	exo.	<naranja, limón>, Old World naturalized tree
Rutaceae	<i>Zanthoxylum rhoifolium</i> Lam.	LO	nat.	<lagartillo>, locally rare tree
Sapindaceae	<i>Cupania glabra</i> Sw.	ca, LO*	nat.	<casuá>, tree species (<i>Ostrinotes keila</i> ; <i>Catocyclotus adelina</i>)
Sapindaceae	<i>Paullinia</i> sp.	LO	nat.	climbing species

TABLE 1 (Continued)
List of plants found on the University of Costa Rica main campus

Family	Species	Location	Status	<Common local name>, comments, (butterfly species)
Sapindaceae	<i>Sapindus saponaria</i> L.	ca, LO	non.	<chumico, jaboncillo>, introduced from lowland
Sapindaceae	<i>Thouinidium decandrum</i> (Humb. & Bonpl.) Radlk.	ca, LO	non.	<sardino>, introduced from lowland
Sapotaceae	<i>Manilkara chicle</i> (Pittier) Gilly	LO	non.	<níspero>, introduced from lowland
Sapotaceae	<i>Pouteria fossicola</i> Cronquist	ca, LO	nat.	<zapote>, tree species
Sapotaceae	<i>Pouteria reticulata</i> (Engl.) Eyma	LO	non.	<zapotillo>, introduced from lowland
Sapotaceae	<i>Sideroxylum capiri</i> (A. DC.) Pittier	LO	non.	<tempisque>, young trees introduced from lowland
Scrophulariaceae	<i>Castilleja arvensis</i> Schldt. & Cham.	ca	nat.	uncommon secondary growth shrub
Scrophulariaceae	<i>Mazus pumilus</i> (Burm. f.) Steenis	ca	exo.	Asian naturalized weed
Simaroubaceae	<i>Picramnia antidesma</i> Sw.	LO	nat.	<amargo>, understory shrub
Simaroubaceae	<i>Simarouba amara</i> Aubl.	ca	non.	<aceituno>, introduced from lowland
Solanaceae	<i>Acnistus arborescens</i> (L.) Schldt.	ca*, LO, ng	nat.	<gütite>, pioneer shrub or small tree, flowers visited by many butterflies, fruits eaten by many animal species, Fig. 24
Solanaceae	<i>Browallia americana</i> L.	ca	nat.	<no me olvides>, small herb in open places
Solanaceae	<i>Brugmansia</i> sp.	ca, LO	exo.	<reina de la noche>, Andean ornamental shrub
Solanaceae	<i>Brunfelsia calycina</i> Benth.	ca, ng	exo.	South American ornamental shrub
Solanaceae	<i>Cestrum tomentosum</i> L. f.	ca, LO	nat.	<zorrillo>, stinking pioneer shrub or tree (<i>Godyris nero</i>)
Solanaceae	<i>Cestrum</i> sp.	LO	nat.	<zorrillo>, secondary growth shrub
Solanaceae	<i>Solanum torvum</i> Sw.	ca, LO	nat.	<berenjena cimarrona>, ruderal species
Solanaceae	<i>Solanum umbellatum</i> Mill.	ca, LO	nat.	<zorrillo>, stinking ruderal species (<i>Dircenna klugii</i>)
Solanaceae	<i>Witheringia solanacea</i> L'Her.	LO, ng	nat.	<tomatillo>, secondary growth herb
Sterculiaceae	<i>Byttneria aculeata</i> (Jacq.) Jacq.	LO	nat.	thorny herbaceous species
Sterculiaceae	<i>Guazuma ulmifolia</i> Lam.	LO	non.	<guácimo>, young cultivated trees from lowland dry forest
Tiliaceae	<i>Heliocarpus</i> cf. <i>appendiculatus</i> Turcz.	ng	nat.	<burío>, pioneer tree species
Tiliaceae	<i>Triumfetta semitriloba</i> Jacq.	LO	nat.	<mozote>, small medicinal shrub
Ulmaceae	<i>Trema micrantha</i> (L.) Blume	ca	nat.	<jucó>, pioneer tree species
Urticaceae	<i>Phenax rugosus</i> (Poir.) Wedd.	ca, ng	nat.	small shrub in open places
Urticaceae	<i>Pilea cadieri</i> Gagnep. & Guillaumin	LO, ng	exo.	<hierba de aluminio>, Southeast Asian ornamental
Urticaceae	<i>Pilea hyalina</i> Fenzl.	LO, ng	nat.	small fleshy herb
Urticaceae	<i>Pilea microphylla</i> (L.) Liebm.	ca*, LO, ng	nat.	very common small herb in open places
Verbenaceae	<i>Citharexylum donnell-smithii</i> Greenm.	ca, LO	nat.	<dama>, shrub or small tree
Verbenaceae	<i>Clerodendrum paniculatum</i> L.	LO, ng	exo.	Southeast Asian ornamental shrub
Verbenaceae	<i>Lantana camara</i> L.	ca, ng	nat.	<cinco negritos>, ruderal small shrub
Verbenaceae	<i>Stachytarpheta</i> sp.	ca	non.	<alacrancillo>, cultivated from lowland to attract butterflies
Vitaceae	<i>Cissus verticillata</i> (L.) Nicolson & C.E. Jarvis	ca, LO	nat.	<iasú>, herbaceous climber
Vochysiaceae	<i>Vochysia guatemalensis</i> Donn. Sm.	LO	non.	<palo de mayo>, cultivated from lowland
Zygophyllaceae	<i>Guaiacum sanctum</i> L.	ca, LO, ng	non.	<guayacán real>, young cultivated trees from lowland dry forest

This list consists with plants recorded inside of loop-line road as indicated in figure 5. Common species with more than 10 plants observed between 2004 and 2007 are indicated with * after location. Location: plants found on the UCR campus outside of Reserva ecológica Leonelo Oviedo = ca; in Leonelo Oviedo = LO; in nursery garden in Leonelo Oviedo = ng. Status: native to Premontane Moist Forest of the region = nat.; non-native to the area, but found naturally in Costa Rica = non. (emphasized in grey); exotic = exo. (emphasized in grey), bold letters emphasizing **non.** and **exo.** found in the Leonelo Oviedo Ecological Preserve (RELO). Butterfly species hosted are indicated in bold parentheses in the comments column. The word Captive, indicates that the plant was given as food plant under captive conditions, resulted in successful adult emergence.

i.e. were absent in the nursery garden or on UCR campus. There were 117 species in the nursery garden and 33 species (*ca.* 28%) of these were found only on that site. On the rest of the campus indicated in figure 5, we recorded 317 species; 142 species (*ca.* 45%) of these were absent either from the nursery garden or the RELO.

Most of the plants on UCR campus (excluding the RELO), whether native or introduced, were planted as ornamentals. Consequently, only 57% (182 species) of the campus flora was composed of native Costa Rican species. In the RELO, 86% of flora (179 species) was native to Costa Rica; though not all these species were native to the studied site, i.e. were either manually planted or escaped from cultivation and arrived at the Preserve either before or after the preservation of the area as the RELO. Roughly one-third (59) of the 179 Costa Rican species naturally does not occur in the Preserve or in the Premontane Moist Forest habitat of the region. Most of these plants were composed of young cultivated trees, species that usually grow in secondary forests in lowland regions of Costa Rica. Regarding just the tree species of the Preserve, there were 36 native-to-region species, which is 17.6% of the RELO total flora. The 36 tree species account for approximately 30% of all native-to-region plants including shrubs and herbaceous species.

In the RELO, basically two floristic components were observed. One was composed of secondary growth herbs, shrubs, and trees, with a very few mature large vegetations which are survivors from the ancient forests of the region. Regarding the presence of the remnant large native trees, it appeared to be favored by the presence of the Negritos River, because most of these trees were found along the river banks. The other component was composed of various planted, introduced tree species from lowland and a smaller number from the highland of Costa Rica, as well as a few exotic tree species. Native-to-region tree species commonly occurring in the RELO were *Stemmadenia litoralis* (Apocynaceae),

Cordia eriostigma (Boraginaceae), *Cecropia obtusifolia* (Cecropiaceae) (Fig. 23), *Croton draco*, *Sapium glandulosum* (Euphorbiaceae), *Inga punctata*, *Lonchocarpus cf. oliganthus* (Fabaceae), *Licaria triandra*, *Persea caerulea* (Lauraceae), *Trichilia havanensis* (Meliaceae), and *Acnistus arborescens* (Solanaceae) (Fig. 24). In contrast, *Ficus cf. citrifolia* (Moraceae) and *Zanthoxylum rhoifolium* (Rutaceae) were floristically considered rare in the Preserve. Other rare species in the RELO were: a terrestrial herb, *Govenia cf. liliacea* (Orchidaceae); a riparian herb, *Hygrophila costata* (Acanthaceae); an herbaceous climber, *Torretia lappacea* (Bignoniaceae); and two shrubs, *Acalypha leptopoda* (Euphorbiaceae) and *Podachaenium eminens* (Asteraceae). This last species once commonly occurred in urbanized areas of San José, though presently it is close to local extinction. Therefore, the Preserve may well be one of the last refuges for the species in this region. Currently, three individuals were recognized in the southwestern limit of the Preserve, indicating a possible recovery of a small population.

Most of the invasive plants found in the RELO consisted of introduced exotic ornamentals (e.g. *Erythrina poeppigiana*, *Impatiens walleriana*, *Megaskepasma erythrochlamys*, *Syzygium jambos*), weeds (e.g. *Cyperus involucratus*, *Pennisetum purpureum*) and some crops and fruit trees (especially *Coffea arabica*, *Mangifera indica*, and *Eriobotrya japonica*) which escaped from cultivation. In Costa Rica, the fast-growing, large, northern South American *Erythrina poeppigiana* trees are commonly planted as fence trees on farm lands and as shadow trees in coffee plantations. This species has been reproducing itself very successfully in the RELO where we have seen hundreds of saplings and germinating seeds, especially in the rainy seasons of the last two years. Monitoring and controlling all exotics and species that are not native to the region is necessary, especially when they become invasive and affect native flora and fauna. This could apply also to some of the native species to establish healthy conditions of the Preserve for its regeneration. For example, approximately 10 years

ago thickets of *Ipomoea santillanii* were very abundant, covering most of the forest floor and hindering the growth of small trees, thus it was necessary to control (Di Stéfano 1996). At present it appears that a control of *Chamaedorea costaricana* is necessary since its thickets are covering the forest floor quite heavily in some parts of the Preserve. Another locally native species which is possibly invasive is *Pseuderanthemum cuspidatum* (Fig. 16).

Today the forest floor is more shaded than 10 years ago; hence, we must note that the flora and fauna of the Preserve changes as the forest grows. For example, the shrubs of *Psychotria marginata* (Rubiaceae) which grow in slightly open understory have slowly been weakening, wilting, and disappearing during the last few years. Also some drastic changes may occur as large trees fall and destroy the others, or small plants, especially occasional small herbs will suffer by the periodic trimming of the plants in open areas of the campus.

Butterflies and day-flying moths

(Figs. 25-38, Table 2)

Table 2 lists 203 species of butterflies and 20 species of day-flying moths thus far recorded in the RELO. The list also shows the year(s) in which the record is available in order to provide a measure of historical context and the up-to-datedness of the available records, as well as the times of the year in which the presence of each species' adult has been confirmed. Our own study began in 1997, but for the sake of completeness we included the data available from several other sources as described in the materials and methods section. Unfortunately, however, dates of collecting were not always available in those cases. We have been able to confirm the presence of 13 species of Ithomiinae between 1997 and 2007, a far cry from the 29 species Stiles found in 1979 or 1980. Moreover, between 1975 and 1981, Stiles (pers. comm. 2005) observed 40 species of Ithomiinae, a number that approaches 80% of the total species known from Costa Rica. It should be noted, however, that these most likely include

migrating species or strays rather than true residents (G. Stiles pers. comm., 2005), a caveat that applies equally to the rest of the Ithomiinae species we have found ourselves. DeVries (1987) also mentions that this many species might be found in San José for this reason. Of particular interest among the records is *Ithomia celemia*, a species known to be one of the rarest of Costa Rican Ithomiinae. The nearest current habitat of this species is Rodeo (Montero-Moreno 2003; I. Nakamura, unpublished record, 2007). It is not inconceivable that this species was more common in the Central Valley until its main habitats were lost.

We present in Fig. 39 a "collecting curve" of butterflies spanning the 10 year period of our study (note that it does not include day-flying moths). Atypical shape of the curve has several causes. First, we counted any visit to the RELO as a collecting day, regardless of the length of the time spent or the weather condition. Second, when rearing of larvae or pupae ended with adults, the day of adult emergence was counted as a visit. Presence of a substantial number of species was first established through rearing, particularly in the early phase of our study, resulting in the slow rate of rise early in the curve. Third, our effort to inventory the HesperIIDae of the RELO did not begin in earnest until relatively late. In any event, the curve clearly indicates that our list is far from complete and that our effort needs to continue.

Generally speaking, the butterfly fauna of the RELO seems notable for the common occurrence of some species which are seldom encountered or at least much less common elsewhere. These include *Synale cynaxa* (Hesperiidae, Hesperinae), the two *Hesperocharis* species (Pieridae, Pierinae), and *Catocyclotis adelina* (Riodinidae, Riodininae) (Fig. 33). None of these species appear in Fulton's list (1966) or in Vega & Gloor (2001). It is possible that the relatively common occurrence of these species in the RELO simply reflects availability of uncommon host plants and other favorable conditions. Alternatively, these species may represent a remnant of the former fauna of the Central Valley.

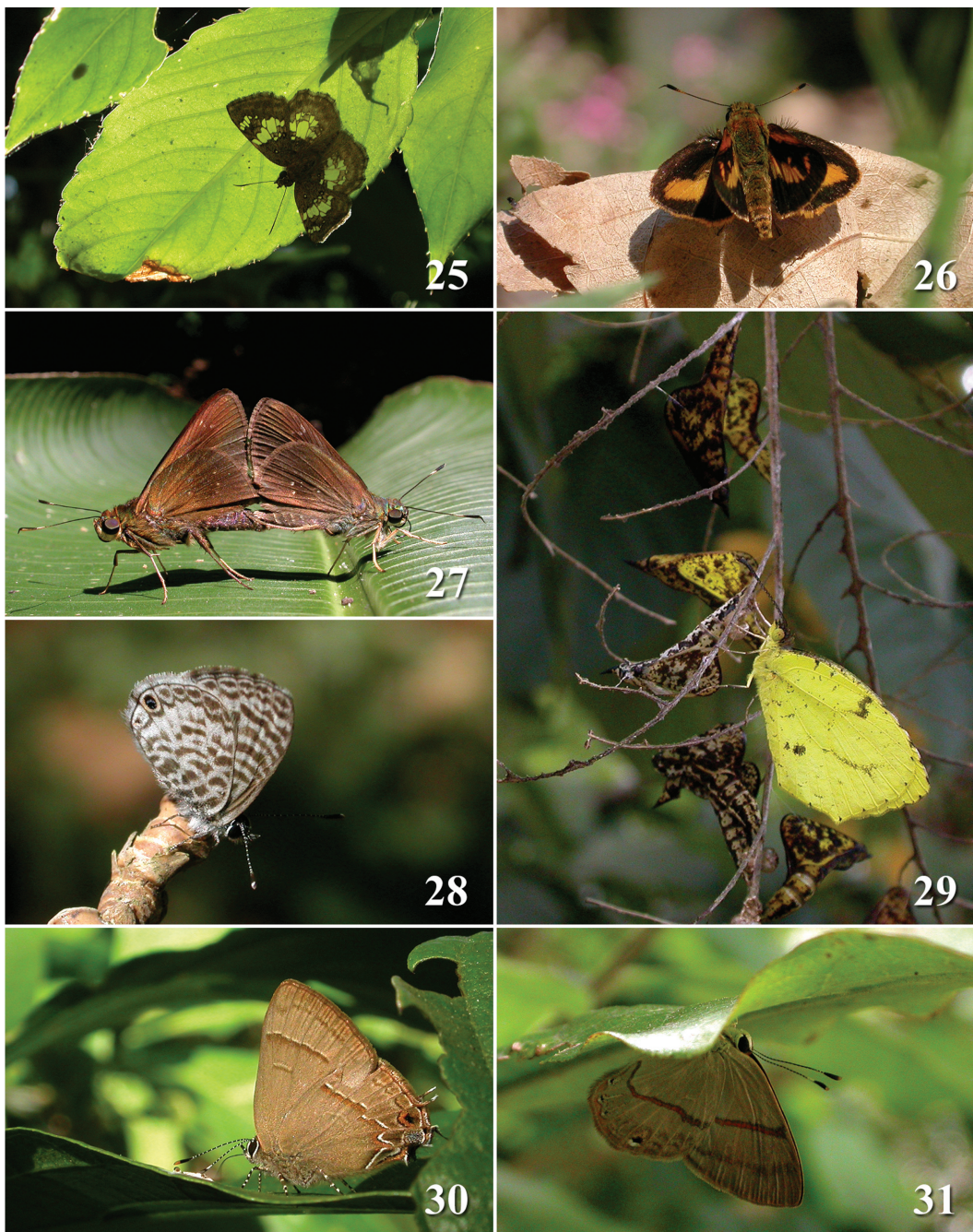


Fig. 25. *Xenophanes tryxus* perched on underside of *Impatiens* leaf (8:30 am, March 25, 2004). **Fig. 26.** *Anthoptus epictetus* on a dry leaf on ground basking (9:00 am, March 25, 2004). **Fig. 27.** *Cynea cynea* showing mating behavior (male on right rubbing female's abdomen with its hind legs) on *Heliconia* leaf (1:00 pm, April 25, 2004). **Fig. 28.** *Leptotes cassius* on dry twig (9:30 am, March 25, 2004). **Fig. 29.** *Eurema xanthochlora* mature and empty pupae, a recently eclosed adult drying its wings on *Senna papillosa* (10:00 am, Sept. 17, 2003). **Fig. 30.** *Calycopsis isobeon* or *C. origo* (female) feeding on bird dropping near ground level (4:00 pm, March 23, 2004). **Fig. 31.** *Euselasia mystica* resting on underside of *Eugenia* leaf (11:00 am, April 1st, 2004).



Fig. 32. *Mesosemia telegone* on underside of *Heliconia* leaf (10:00 am, March 17, 2007). **Fig. 33.** *Catocyclotis adelina* (female) resting on underside of *Inga vera* leaf between ovipositions (10:00 am, July 6, 2000). **Fig. 34.** *Ithomia patilla* perching on *Commelina* leaf (1:00 pm, August 25, 2003). **Fig. 35.** *Castilia griseobasalis* on a dry twig in light gap (12:00 pm, March 27, 2004). **Fig. 36.** *Oxeoschistus taupopolis* on a leaf near forest floor in light gap (11:00 am, April 1st, 2004). **Fig. 37.** *Heliconius charithonia* on flowers of *Pentas lanceolata* in the nursery garden (11:00 am, April 22, 2006). **Fig. 38.** *Heliconius erato* showing courtship behavior in light gap; female perched on leaf near ground and male in fluttery flight approaching the female (1:30 pm, December 14, 2002).

TABLE 2
List of butterflies and day-flying moths found in Reserva Ecológica Leonelo Oviedo (RELO)

Family: Subfamily / Species	year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Hesperiidae: Pyrginae													
<i>Achlyodes pallida</i> (R. Felder, 1869)	99,03,04,07												
<i>Astraptes alardus</i> (Stoll, 1790)	96,98-00,03,04	R											
<i>Astraptes anaphus</i> (Cramer, 1777)	00,03-06	R					/ / /						
<i>Atarnes sallei</i> (Felder & Felder, 1867)	98,05								R				
<i>Autoclytus vectilicis</i> (Butler, 1872)	05												
<i>Staphylus</i> sp. (possibly two species)	03-05												
<i>Bolla oiclus imbrus</i> (Godman & Salvin, 1896)	99										R		
<i>Heliopterus alana</i> (Reakirt, 1868)	96,03,04				/ / /								
<i>Heliopterus arsalte</i> (Linnaeus, 1758)	97												
<i>Noctuana lactifera</i> (Butler & Druce, 1872)	00,01,05						/ / /						
<i>Polythrix asine</i> (Hewitson, 1867)	03						/ / /						
<i>Pyrgus communis adepta</i> Plötz, 1884	00						/ / /						
<i>Pyrgus oileus</i> (Linnaeus, 1767)	98,03,04												
<i>Sosstrata bifasciata</i> (Menétries, 1829)	04												
<i>Staphylus ascalaphus</i> (Staudinger, 1876)	98,01,03-05												
<i>Urbanus dorantes</i> (Stoll, 1790)	04												
<i>Urbanus procle</i> (Plötz, 1880)	98												
<i>Urbanus teleus</i> (Hübner, 1821)	00,03				/ / /								
<i>Urbanus viterboana</i> (Ehrmann, 1907)	03												
<i>Urbanus</i> sp. #1	04					/ / /							
<i>Urbanus</i> sp. #2	99					/ / /							
<i>Xenophanes tryxus</i> (Stoll, 1780)	04,05						/ / /						
<i>Zera hyacinthinus</i> (Mabille, 1877)	97,04						/ / /						
<i>Zera phila hosta</i> Evans, 1953	04						/ / /						
Hesperiidae: Heteropterinae													
<i>Dalla ligilla</i> (Hewitson, 1877)	04				M								
Hesperiidae: Hesperinae													
<i>Ancyloxypha arene</i> (W.H. Edwards, 1871)	97												
<i>Anthoptus epicleus</i> (Fabricius, 1793)	04,06												
<i>Buzayges rolla</i> (Mabille, 1883)	03-05												
<i>Callinormus juvenis</i> Scudder, 1872	04												
<i>Cobalopsis autumnia</i> (Plötz, 1882)	03												

TABLE 2 (Continued)
List of butterflies and day-flying moths found in Reserva Ecológica Leonelo Oviedo (RELO)

Family: Subfamily / Species	year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Cobalopsis nero</i> (Herrich-Schäffer, 1869)	04												
<i>Cobalopsis</i> sp.	04												
<i>Conga chrydaea</i> (Butler, 1877)	03-06												
<i>Cymaenes odilia</i> (Burmeister, 1878)	03,04										/ / /		
<i>Cyneia cynea</i> (Hewitson, 1876)*	92,00,01,03-05				M						/ / /		
<i>Cyneia cf. diluta</i> (Herrich-Schäffer, 1869)	03,05												
<i>Eutocus cf. facilis</i> (Plötz, 1884)	04												
<i>Halotus rica</i> (Bell, 1942)	04												
<i>Morys valerius</i> (Möschler, 1879)	05												
<i>Mucia zygia</i> (Plötz, 1886)	04,05												
<i>Naevolus orius</i> (Mabille, 1883)	04												
<i>Niconiades nikko</i> Hayward, 1948	04												
<i>Oxyntes corusca</i> (Herrich-Schäffer, 1869)	98,04												
<i>Panoquina lucas</i> (Fabricius, 1793)	04												
<i>Papilio subcostulata</i> (Herrich-Schäffer, 1870)	03												
<i>Perichares deceptus</i> (Butler & Druce, 1872)	98,99	R											
<i>Perichares lotus</i> (Butler, 1870)	98,99,04-06	R						/ / /					
<i>Poanes inimica</i> (Butler & Druce, 1872)	03												
<i>Poanes zabulon</i> (Boisduval & LeConte, [1837])	01,04,06						/ / /						
<i>Pompeius pompeius</i> (Latreille, [1824])	99,00,03-05						/ / /						
<i>Quinta cannae</i> (Herrich-Schäffer, 1869)	04												
<i>Remella rita</i> (Evans, 1955)	98,03,04,06												
<i>Rhithon cubana</i> (Herrich-Schäffer, 1865)	04												
<i>Saliana antoninus</i> (Latreille, [1824])	03,04												
<i>Saliana triangularis</i> (Kaye, 1914)	04												
<i>Saliana</i> sp.	03,04												
<i>Synale cynaxa</i> (Hewitson, 1867)	98-00,03,04,05												
<i>Synapte salenus</i> (Mabille, 1883)	97,03,04						R						
<i>Theopieus macareus</i> (Herrich-Schäffer, 1869)	04												
<i>Yacerra cervara</i> Steinhäuser, 1994	04-06						/ / /						
<i>Zenis jebus</i> (Plötz, 1882)	03												
Unidentified sp. #1	03												
Unidentified sp. #2	04												

TABLE 2 (Continued)
List of butterflies and day-flying moths found in Reserva Ecológica Leonelo Oviedo (RELO)

Family: Subfamily / Species	year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Unidentified sp. #3	04												
Unidentified sp. #4	97,03												
Papilionidae: Papilioninae													
<i>Heracles anchisiades</i> (Esper, 1788)	84,03,04												
<i>Heracles androgeus</i> (Cramer, 1775)	86												
<i>Papilio polyxenes</i> Fabricius, 1775	86												
Pieridae: Dismorphiinae													
<i>Dismorphia amphione</i> (Cramer, 1779)	92,00,03,07												
<i>Dismorphia crisia</i> (Drury, 1782)	88												
<i>Lienix nemesis</i> (Latreille, [1813])	04												
Pieridae: Coliadinae													
<i>Aphrissa statira</i> (Cramer, 1777)	01,04												
<i>Eurema albula</i> (Cramer, 1775)	99												
<i>Eurema arbela</i> Geyer, 1832	98												
<i>Eurema daira</i> (Godart, 1819)	98,04												
<i>Eurema mexicana</i> (Boisduval, 1836)	04												
<i>Eurema salome</i> (Felder & Felder, 1861)	96,98,01,03,04												
<i>Eurema xanthochlora</i> (Kollar, 1850)	98,00,03-05												
<i>Phoebis argante</i> (Fabricius, 1775)	04												
<i>Phoebis philea</i> (Linnaeus, 1763)	87,01,03												
<i>Phoebis semae</i> (Linnaeus, 1758)	84,98,04												
<i>Pyrisitia dina</i> (Poey, 1832)	94,96,03,04												
<i>Pyrisitia nise</i> (Cramer, 1775)	98,04												
<i>Pyrisitia proterpia</i> (Fabricius, 1775)	03,04												
Pieridae: Pierinae													
<i>Ascia monuste</i> (Linnaeus, 1764)	84,96,98,04,05												
<i>Catasticta nimbice</i> (Boisduval, 1836)	96,05												
<i>Hesperocharis costaricensis</i> Bates, 1866	05,07												
<i>Hesperocharis crocea</i> Bates, 1866	00,05												
<i>Leptophobia aripa</i> (Boisduval, 1836)	99,04												
<i>Pierballia viandi</i> (Boisduval, 1836)	98												
Lycanoidae: Theclinae													
<i>Arawacus sito</i> (Boisduval, 1836)	04												

TABLE 2 (Continued)
List of butterflies and day-flying moths found in Reserva Ecológica Leonelo Oviedo (RELO)

Family: Subfamily / Species	year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Calycopis isobon</i> (Butler & H. Druce, 1872) or <i>C. origo</i> (Godman & Salvin, 1887)	97,98,01-06						/	/ / /					
<i>Cyanophrys amyntor</i> (Cramer, 1775)	04											/ / /	
<i>Electrostrymon sangula</i> (Hewitson, 1868) or <i>E. joya</i> (Dognin, 1895)	03												
<i>Laolthus barajoi</i> (Reakirt, [1867])	04												
<i>Oenomaus orygnus</i> (Cramer, 1779)	87					R							
<i>Ostrinotes keila</i> (Hewitson, 1869)	04						R						
<i>Pseudolycaena damo</i> (Druce, 1875)	04,05												
<i>Rekoa marius</i> (Lucas, 1857)	00R(ex pupa, campus)												
<i>Rekoa palegon</i> (Cramer, 1780)	03,04												
<i>Sirymon cestri</i> (Reakirt, [1867])	98,03,05												
<i>Tmolus echion</i> (Linnaeus, 1767)	04												
<i>Ziegleria hoffmani</i> Johnson, 1993	04												
<i>Ziegleria sylis</i> (Godman & Salvin, 1887)	04,05												
Unidentified sp.	04												
Lycenidae: Polyommatainae													
<i>Echinargus isola</i> (Reakirt, [1867])	05							/ / /					
<i>Leptotes cassius</i> (Cramer, 1775)	04												
Riodinidae: Euselasiinae													
<i>Euselasia mystica</i> (Schaus, 1913)	99,03,04												
Riodinidae: Riodininae													
<i>Baeotis zonata</i> R. Felder, 1869	04												
<i>Calephelis costaricola</i> Strand, 1916	97,98												
<i>Catocyclotis adelina</i> (Butler, 1872)	00-05												
<i>Emesis mandana</i> (Cramer, 1780)	00												
<i>Emesis tenedia</i> Felder & Felder, 1861	04												
<i>Eurybia elvina</i> Stichel, 1910	06												
<i>Eurybia lycisca</i> Westwood, 1851	04,06												
<i>Mesosemia telegone</i> (Boisduval, 1836)	05,07												
<i>Napaea umbra</i> (Boisduval, 1870)	04												
<i>Rhetus arcus</i> (Linnaeus, 1763)	97,99,00												
<i>Thisbe lycorias</i> (Hewitson, [1853])	00,01												

TABLE 2 (Continued)
List of butterflies and day-flying moths found in Reserva Ecológica Leonelo Oviedo (RELO)

Family: Subfamily / Species	year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Nymphalidae: Danainae													
<i>Danaus eresimus</i> (Cramer, 1777)	96					/ / /							
<i>Danaus plexippus</i> (Linnaeus, 1758)	96,03,05		/										
<i>Lycoreia halia atvergatis</i> Doubleday, [1847]	07												
Nymphalidae: Ithomiinae													
<i>Ceratinia tutia</i> (Hewitson, 1852) [–]	79-80												
<i>Dircenna dero</i> (Hübner, 1823) [–]	79-80												
<i>Dircenna jeminia</i> (Geyer, 1837) [–]	79-80												
<i>Dircenna klugii</i> (Geyer, 1837)	79-80,03,04				E								
<i>Dircenna ohyras relata</i> Butler & Druce, 1872	79-80,88,96,97												
<i>Episcada salvinia</i> (Bates, 1864)	79-80,03,05,07					/ /							
<i>Eutresis hyperetia</i> Doubleday, 1847	78												
<i>Godyris nero</i> (Hewitson, [1855])	00			R									
<i>Godyris zavaleta</i> (Hewitson, [1855]) [–]	79-80												
<i>Greta andronica</i> (Hewitson, [1855]) [–]	79-80												
<i>Greta amette</i> (Guérin-Mèneville, [1844]) [–]	79-80												
<i>Greta morgane</i> (Geyer, 1837)*	79-80,96,97,00,01,04-07					/ / /		/ / /					
<i>Hypoleria lavinia</i> (Hewitson, [1855]) [–]	79-80												
<i>Hyposcada virginiana</i> (Hewitson, [1855]) [–]	79-80,04												
<i>Hyalyris excelsa decumana</i> (Goman & Salvin, 1879) [–]	79-80												
<i>Hypothyris euclea</i> (Godart, 1819) [–]	79-80												
<i>Hypothyris lycaste</i> (Fabricius, 1793) [–]	79-80												
<i>Ithomia celemia</i> Hewitson, [1854] [–]	78												
<i>Ithomia diasia</i> Hewitson, 1854 [–]	79-80												
<i>Ithomia herraldica</i> Bates, 1866*	79-80,92,96,97-01,03,04					/ / / /		/ / /		B			
<i>Ithomia jucunda</i> Godman & Salvin, 1878	01					/ / /		/ / /					
<i>Ithomia patilla</i> Hewitson, 1852*	79-80,87,92,96,98,99,03,06			/ /		/ / /		/ / /		B			
<i>Ithomia xenos</i> (Bates, 1866)	79-80,03												
<i>Mechanitis menapis</i> Hewitson, [1856]	79-80,01												
<i>Mechanitis polymnia</i> (Linnaeus, 1758)	79-80,98,04					/ / /		/ / /					

TABLE 2 (Continued)
List of butterflies and day-flying moths found in Reserva Ecológica Leonelo Oviedo (RELO)

Family: Subfamily / Species	year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Napeogenes tolosa</i> (Hewitson, 1855)	79-80												
<i>Oleria paula</i> (Weymer, 1883)	76												
<i>Oleria vicina</i> (Salvin, 1869)	96,04					/ / /							
<i>Pteronymia aletia agallia</i> Godman & Salvin, 1879	79-80,98,07												
<i>Pteronymia artena</i> (Hewitson, [1855])	79-80												
<i>Pteronymia latilla fulvescens</i> Godman & Salvin, 1879	79-80					/ / /							
<i>Pteronymia picta notilla</i> Butler & Druce, 1872	79-80,99,03,07												
<i>Pteronymia simplex</i> (Salvin, 1869)	79-80												
<i>Thyridia psidii melaniho</i> Bates, 1866	79-80												
Nymphalidae: Morphinae													
<i>Morpho helenor marinita</i> Butler, 1872	07												
Nymphalidae: Brassolinae													
<i>Caligo eurilochus</i> (Cramer, 1775)	96												
<i>Caligo telamonius memnon</i> (Felder & Felder, 1867)	04												
<i>Opsiphanes cassina</i> Felder & Felder, 1862	87,97,04			B R B	/ / /								
<i>Opsiphanes tamarindi</i> Felder & Felder, 1861	87												
Nymphalidae: Satyrinae													
<i>Cyllopsis pephredo</i> (Godman, 1901)	00,01,04			B	B	B							
<i>Drucina leonata</i> Butler, 1872	42,01,04			B									
<i>Hermeytychia hermes</i> (Fabricius, 1775)	98,03,04												
<i>Manataria hercyna maculata</i> (Hopffer, 1874)	98,99,02,04			B B	B B	B B B B							
<i>Oreochisus tauripolis</i> (Westwood, [1850])*	96,98,00-04,06			B B	B B	R R R R							
<i>Pedaliodes dejecta</i> (Bates, 1865)	96,00					R	B						
<i>Pedaliodes manis</i> (Felder & Felder, 1867)*	98,00-04				B B	R R							
<i>Satyrotagetis satyrina</i> (Bates, 1865)	98,00,03,04,07												
<i>Ypthimoides renata</i> (Stoll, 1780)	98,04				B								
Nymphalidae: Charaxinae													
<i>Archaeoprepona meander</i> (Cramer, 1775)	96,98			/ / /									
<i>Consul fabius</i> (Cramer, 1776)	98												
<i>Fountainea eurypyle</i> (Felder & Felder, 1862)	98,04			B									
<i>Fountainea glycerium</i> (Doubleday, [1849])	04			B									
Nymphalidae: Biblidinae													
<i>Diathria astala</i> (Guérin-Ménéville, [1844])	98,04			B B									

TABLE 2 (Continued)
List of butterflies and day-flying moths found in Reserva Ecológica Leonelo Oviedo (RELO)

Family: Subfamily / Species	year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Epiphile adrasia</i> Hewitson, 1861	04				B								
<i>Hamadryas februa</i> (Hübner, [1823]) ⁻	00(campus)												
<i>Marpesia petreus</i> (Cramer, 1776)	02-05												/ / /
Nymphalidae: Nymphalinae													
<i>Anartia fatima</i> (Fabricius, 1793)	96,97,00,03,04,07			/ / /		/	/						
<i>Anartia jatrophae</i> (Linnaeus, 1763)	96												
<i>Anthanassa ardis</i> (Hewitson, 1864)*	96-98,01,04-06			/ / /									
<i>Anthanassa atanes fulvipalaga</i> (Butler, 1872)	03,04,07												
<i>Castilia griseobasalis</i> (Röber, 1913)	04,05												
<i>Chlosyne janais</i> (Drury, 1782)	97-99,03-06												
<i>Colobura dirce</i> (Linnaeus, 1758)	98,02,04,07				B	B			B			B	B
<i>Historis acherontia</i> (Fabricius, 1775)	99,04		/ / B									R	
<i>Historis odius</i> (Fabricius, 1775)	02												
<i>Junonia evarete</i> (Cramer, 1779)	99												
<i>Siproeta epaphus</i> (Latreille, [1813])	98,03,04,06							/ / /				R	
<i>Siproeta stelenes</i> (Linnaeus, 1758) ⁻	03												
<i>Smymna blomfieldia</i> (Fabricius, 1781)	98,04			B					B				B
<i>Tegosa anieta</i> (Hewitson, 1864)	04,06												
Nymphalidae: Heliconiinae													
<i>Actinote anteus</i> (Doubleday, [1847])	03,04												
<i>Alinote ozomene nox</i> (Bates, 1864)	05,07												
<i>Dione juno</i> (Cramer, 1779)	01						/ / /						
<i>Dione moneta</i> Hübner, [1825]	04												
<i>Dryadula phaetusa</i> (Linnaeus, 1758)	04												
<i>Dryas iulia</i> (Fabricius, 1775)	96,98,01,03,04,07					/ /							
<i>Eueides isabella</i> (Stoll, 1781)	96												
<i>Eueides procula</i> Doubleday, [1847]	00												
<i>Heliconia charitonia</i> (Linnaeus, 1767)	88,89,96,04	/											
<i>Heliconius clysonymus</i> Latreille, [1817]	96,97,01,04				/ / /								
<i>Heliconius erato</i> (Linnaeus, 1758)*	96,98,03,04,07												
<i>Heliconius hecale</i> (Fabricius, 1776)	98,03,04												
<i>Heliconius ismenius</i> Latreille, [1817]	04												

TABLE 2 (Continued)
List of butterflies and day-flying moths found in Reserva Ecológica Leonelo Oviedo (RELO)

Family: Subfamily / Species	year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Pieridae													
<i>Mapeta xanthomelas</i> Walker, 1863	00												
Unidentified sp. (clear wing, black-metallic blue wasp-like)	99,07												
Uranidae													
<i>Urania fulgens</i> (Walker, 1854)	90,97,98,05-07		/ /										
Geometridae													
<i>Apyria commoda</i> Prout, 1938	02,05												
<i>Melanchroia chephise</i> (Stoll, 1782)	04,07												
<i>Simena lucifera</i> Walker, 1856	99,06,07	R				/ / / / / /	/ / / / / /	/ / / / / /					
Notodontidae: Dioptinae													
<i>Josia frigida</i> Druce, 1885	04												
<i>Tithraustes mirma</i> (Druce, 1899)	05					/ / /	/ / /	/ / /					
Arctiidae													
<i>Aclytia heber</i> (Cramer, 1780)	90		/ / /	/ / /	/ / /	/ / /	/ / /	/ / /					
<i>Amycles adusta</i> (Felder, 1874)	07												
<i>Andorea morio</i> (Walker, 1854)	06												
<i>Argyrodes notha</i> Schaus, 1911	07												
<i>Cacostatia saphira</i> (Staudinger, 1875)	97												
<i>Correbidia</i> sp.	00												
<i>Cyanopepla arrogans</i> (Walker, 1854)	99												
<i>Episcepsis lenaeus</i> (Cramer, 1780)	01									R			
<i>Napata leucoetus</i> (Butler, 1876)	00												
<i>Nyrtidela xanthocera</i> (Walker, 1856)	98												
<i>Phaenarete diana</i> Druce, 1986	97					/ / /	/ / /	/ / /					
<i>Syniomeida melanthus</i> (Cramer, 1779)	96					/ / /	/ / /	/ / /					

*Common' species seen throughout the year from 2004 to 2007 are indicated with *. after species name. Species without voucher specimens in the entomological collection of Museo de Zoología, UCR are indicated with after species name. Each month is divided into three 10-day periods, left =early, middle = middle, right = late, and the cells for recorded periods are filled with gray color; **E** = egg laying observed, **R** = reared, **M** = mating, **B** = bait trap, / = data without specific dates (only month), bold letters in year = data with only the year available.

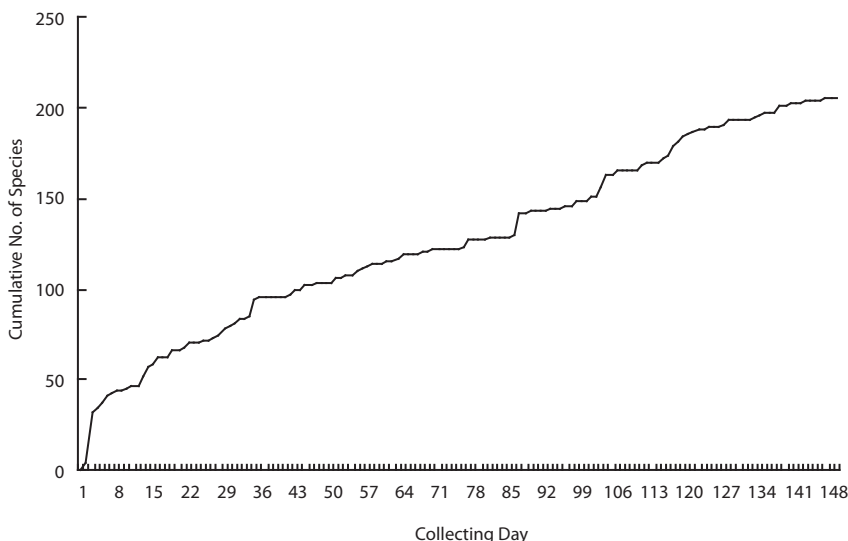


Fig. 39. "Collecting curve" of butterflies spanning the 10 year period of our study. X-axis = number of collecting day; Y-axis = cumulative number of species.

The following species were commonly seen in the RELO throughout the year: *Greta morgane*, *Ithomia heraldica*, *I. patilla* (Fig. 34) (Ithomiinae), *Oxeoschistus tauropolis* (Fig. 35), *Pedaliodes manis*, *Hermeuptychia hermes* (Satyriinae), and *Heliconius erato* (Fig. 38) (Heliconiinae). In almost every visit, at least one individual of these species was encountered along the trail. Other common species include *Astrartes*, *Staphylus*, *Urbanus*, *Callimormus*, *Cynea* (Fig. 27), *Papias*, *Poanes* (Fig. 26), and *Saliana* species in Hesperiiidae; *Eurema* (Fig. 29) and *Phoebis* species in Pieridae; *Calycopis* (Fig. 30) in Lycaenidae; *Calephelis* and *Catocyclotis* (Fig. 33) in Riodinidae; *Pteronymia notilla* in Ithomiinae; *Anthanassa ardys*, *Castilia griseobasalis* (Fig. 36) in Nymphalinae; *Dryas iulia*, and *Heliconius charithonia* (Fig. 37) in Heliconiinae.

Some butterflies were observed on the following naturally occurring food sources: Some skippers (e.g. *Pompeius pompeius* (female) and *Astrartes alardus*) on bird dropping, *Sinala cynaxa* on flower nectar of *Impatiens walleriana*, *Phoebis*, some lycaenids (unidentified) and *Thisbe lycorias* on *Inga vera* (Fig. 20),

Calycopis isobeaon / origo (female) feeding on bird dropping (Fig. 30), *Catocyclotis adelina* (male) on flowers of *Acnistus arborescens* (Fig. 24), several ithomiines on bird droppings or carrion (decomposing insects), overripe *Rivina humilis* fruits (Fig. 18), and accumulated water in *Heliconia* flowers, *Oxeoschistus tauropolis* on sticky secretion on flower-fruit peduncles of *Chamaedorea costaricana* (Fig. 14), *Pedaliodes manis* on flower nectar of the *Impatiens* and decomposing flower of *Monstera deliciosa* on ground, *Heliconius clysonymus* on flower nectar of *Hamelia patens* (Fig. 21). The following species were caught on the flowers of *Acnistus arborescens*: *Cynea* sp.; *Mucia zygia*; *Pompeius pompeius*; *Buzyges rolla*; *Ascia monuste*; *Hesperocharis costaricensis*; *H. crocea*; *Strymon cestri*; *Calycopis isobeaon / origo*; *Ziegleria syllis*; and *Thisbe lycorias*. Those species caught in the plantain-banana traps, placed between 1 to 5 m above ground, are indicated in Table 2.

The well-known behavior of *Hamadryas februa*, perching head-down with the wings open or flying and producing clicking-sounds around the bare trunks of medium to large

trees, has been seen on campus and commented on by casual observers (also from J. Monge-Nájera, pers. comm.).

Importance of the RELO

As stated earlier, the original purpose of establishing the RELO was to protect the area and restore a representative Premontane Moist Forest of the region. However, the current condition of the Preserve may be described as a mosaic of native, non-native-to-region, and exotic plants. Thus, it does not represent a forest truly composed of locally native species and is more like a botanical garden. One of the critical facts that seem to defy the concept of the Ecological Preserve is ongoing planting of trees that are not native to the region. Furthermore, some of those young trees were not even taxonomically identified at the time of planting, clearly diverging from the original purpose and worsening the conditions of the Preserve.

Data from 1991 show that 98% of the Premontane Moist Forest habitat in Costa Rica is deforested, i.e. only 2% remains as Premontane Moist Forest; this remaining tiny portion is composed of 265 fragmented areas with each patch averaging 0.3 km² in size (Sánchez-Azofeifa *et al.* 2001). The percentage and patch sizes are the smallest among all other life zones according to Holdridge (1967) classification. Sánchez-Azofeifa *et al.* (2001) state that "Forests are almost completely eliminated from the Tropical Moist Forest and Premontane Moist Forest life zones, and the level of fragmentation of remaining forests may be more advanced than previously thought." According to J. Lobo (pers. comm. 2007), the data compiled by the Fondo Nacional de Financiamiento Forestal (FONAFIFO 2005) indicate that merely ca. 4500 ha of the Premontane Moist Forest habitat in Costa Rica is still covered by forest, that is, ca. 0.003% of protected areas that include National Parks, Biological Reserves, and Wildlife Refuges, among others. This low percentage presumably resulted from the concentrated distribution of such life zone in the central part of Costa Rica, such as in the Valleys of

Cartago, San Ramón, and especially in the Central Valley (Bolaños *et al.* 1999) where human "development" is prevalent. Therefore, reconditioning and preserving such forest habitat is even more important, including a small patch of green space in the Central Valley such as the RELO.

The small RELO preserve is under pressure from habitat fragmentation, air and water pollution, and invasion of non-native plants, requiring reconditioning to improve its ecosystem. On the other hand, it has been playing important roles for many organisms, and serving the needs of students and researchers. The RELO is likely to yield more new discoveries in addition to those we mentioned earlier, indicating its potential scientific value. It is probable that the ecological conditions of the RELO have been supported by other green areas surrounding the UCR campus and vice versa, especially the areas in Ciudad de la Investigación and Instalación Deportiva of the UCR, including "protected" areas along the rivers (Fig. 2). There are at least two important roles the Negritos Creek plays for the Preserve, namely 1) as a narrow biological corridor for living organisms (Di Stéfano *et al.* 1996) and 2) providing a fair amount of moisture for survival of organisms especially during the dry season.

While a larger connected protected area would be ideal (MacArthur & Wilson 2001, Laurence *et al.* 2006), fragmentation of natural habitat or green space seems inevitable in urban areas where social pressure dominates (Bertsch 2006); however, keeping or creating small preserves like the RELO may be the best current option that we can embrace. Two known projects are presently in progress in the city of San José. One is Proyecto Mariposas en San José, organized by Plan de Arborización Urbana (PLANARBU), Sección de Parques del Municipio, Municipalidad de San José (A. Solórzano, pers. comm. 2005). The other is Proyecto Plás conducted by Programa Bandera Azul Ecológica of Departamento de Educación Ambiental del Ministerio de Educación Pública and JICA (Japan International Cooperation Agency) in Costa Rica with Escuela República de Haití in San Sebastián de Paso Ancho

(Proyecto Plás 2007). These two projects aim to re-create an environment suitable for butterflies and other organisms in the city of San José by planting trees that are locally native, as well as butterfly host plants and flowering plants that are also native. These projects and the existence of the RELO may hopefully slow down the process of species extinction to some extent, and help migratory species that fly through the Central Valley (Haber 1993).

In addition to conservation of biodiversity and habitat, it is clear that green natural space in a city environment is important for many other reasons, e.g., it reduces city noise, provides better water retention to reduce flood frequency, and supplies better air quality (clean moist air) (Sukopp & Werner 1991, Nowak *et al.* 1997, Pickett *et al.* 2001 and references therein, Rudd *et al.* 2002, Chiesura 2004, Ruiz-Jaen & Mitchell 2006). Ongoing habitat destruction and fragmentation, as well as air and water pollution in the Valley will undoubtedly have negative impacts even to the surrounding protected areas, e.g. El Zurquí region of Braulio Carrillo National Park and Zona Protectora El Rodeo.

In spite of the rapid and devastating deforestation of the Central Valley in the past, which most likely was associated with coffee plantations in early 19th century, we still have some plant species native to the region which can be used to restore and improve Premontane Moist Forest. We hope that this study will serve as a basis for further research in the RELO and its surrounding habitats, and for monitoring our environment.

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RESUMEN

Por ser el área más poblada del país, el Valle Central de Costa Rica perdió su hábitat natural; lo poco que queda ha sido alterado en grados variados. Sin embargo, se han realizado algunos estudios para evaluar la necesidad de conservación en esta área. Se presentan inventarios preliminares de plantas, mariposas y polillas diurnas de la Reserva Ecológica Leonelo Oviedo (RELO); una pequeña reserva de bosque húmedo premontano en el campus de la Universidad de Costa Rica, ubicado en la parte urbanizada del Valle. Las mariposas diurnas son uno de los mejores bio-indicadores de la salud del hábitat, porque son muy sensibles a los cambios del ambiente y están estrechamente ligadas a la flora local. Se presenta también una descripción de los caracteres físicos y la historia de la RELO, con ilus-

traciones. Se identificaron aproximadamente 432 especies de ca. 334 géneros en 113 familias de plantas. Sin embargo, solamente 57% de ellas son especies nativas del bosque húmedo premontano de la región; el resto son especies exóticas o introducidas en su mayoría desde tierras bajas. Se han registrado más de 200 especies de mariposas diurnas en seis familias, incluyendo HesperIIDae.

Palabras clave: biodiversidad, conservación biológica urbana, polillas diurnas, Lepidoptera, bosque húmedo premontano, Costa Rica.

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